

# Aviation Week

and *Space Technology*

March 21, 1960

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Space Research in Life Sciences

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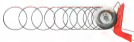
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## AVIATION CALENDAR

(Continued from page 5)

- monies and that Traveler Equipment for Space Flight Applications, Oklahoma State University, Stillwater, Okla.
- Apr. 27-28—National Meeting on Space Age Materials, Cincinnati Chapter of the American Society for Metals, Sheraton Gibson Hotel, Cincinnati, Ohio
- Apr. 28-29—Symposium on "Closed Circuit Respiratory Systems," Wright Air Development Division, Wright Patterson AFB
- May 1-4—Nuclear Accelerated Electronics Conference, Baltimore and Miami Tech. Hotel, Dayton, Ohio. Sponsored by Radio Engineers
- May 2-5—South National Flight Test Symposium, Instrument Society of America, San Diego, Calif.
- May 1-5—F-4's Signal Maintenance Symposium, U. S. Army Signal Equipment Support Agency, Fort Monmouth, N. J.
- May 9-11-1966 Symposium of the South Line of Radio Engineers, Professional Group on Microwave Theory and Techniques, Hotel del Coronado, San Diego
- May 9-12—Soviet Annual Meeting and Associated Symposium, American Rocket Society, Ambassador Hotel, Los Angeles
- May 9-13—Second Southwestern Vandal Congress and Symposium, American Society for Vandal Studies, Dallas Hotel and State Fair Park, Dallas, Tex.
- May 9-13—Annual Conference, Society of Photographic Scientists and Engineers, Missouri Hotel, Los Angeles, Calif.
- May 10-12-1966 Electronic Components Conference, Willard Hotel, Washington, D. C. Sponsored by Institute of Radio Engineers, Professional Group on Component Parts, American Institute of Electrical Engineers, Electronic Industries Assn., Western Electronic Manufacturers Assn.
- May 14-16-1966 Annual National Power Association, Lexington Square, Sheraton Park Hotel, Washington, D. C.
- May 15-14-1966 National Intelligence Flying Meet, Ohio State University, Air Force, Columbus, Ohio
- May 15-15—Annual Convention and Business Meeting, American Soc. of Applied Electronics, Willard Hotel, New York
- May 16-17—Western Fire Safety Seminar, National Fire Protection Assn., Sheraton Elmhurst Hotel, Montreal, Canada
- May 16-20—National Vespene Society for Experimental Design, Institute of Aeronautics, Indianapolis, Ind. Terms: Aeronautics Analysis of Population Systems
- May 22-25—Fourth Annual Reserve National Congress, Congress Hotel, New York
- May 21-25-1966 Annual Meeting, Gamma Society for Rocket Propulsion and Space Flight Research, Huntington, West Germany
- May 24-26-1966 Convention, American Society for Quality Control, San Francisco, Calif.
- Aug. 19-24-1966 Annual Congress International Astronautical Federation, Royal Institute of Technology, Stockholm
- Sept. 3-4-1966 Conference on Flying Display and Exhibition, Society of British Aircraft Constructors, Farnborough, Eng.
- Sept. 12-16-1966 Annual General Meeting, International Air Transport Assn., Copenhagen, Denmark

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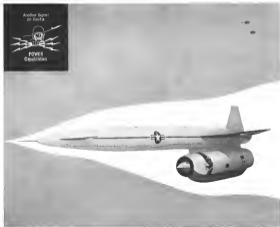
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The B-57 "Hound Dog" carries nuclear missiles. It also carries conventional missiles. Its nuclear missiles are carried by heavy bombers of SAC's Strategic Air Command.

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**COVER:** Buck Aircraft's Model 15 Sabrejet is the company's latest product currently in development. The standard model of the aircraft, four-engine engine aircraft, will be 100 ft. long. The Sabrejet is made in conjunction to the company's 250-hp. 1000 Series engine for the next vertical take-off and simplified aircraft and equipment. For pilot report on Sabrejet see p. 55.

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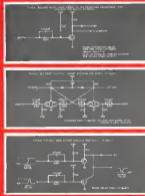


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## EDITORIAL

## Changing the Space Law

Congress is now considering amendments to the National Aeronautics and Space Act of 1958 on the sensible theory that more than a year of opposition to this new act might develop a need for legislative change. A parade of top people working on both the military and civil aspects of space research have testified to the need for some organizational change, most of them centering around the thorny military-civil liaison problem.

There appears to be general agreement that the National Space Council has proved to be a modest appendage during its brief existence, and the formal Civilian Military Liaison Committee established by the law has proved to be little more than a seldom-used letter drop in various circumstances. We think nothing will be lost by the dissolution of these two groups from the space picture. Nor is there much argument that the rather miserably restrictive patent provisions of the original act need immediate time if private industry is to contribute the full scope of its technical and management talents to the space research program.

Several key witnesses, including the Navy's Vice Adm. John T. Hayward and the Army's Lt. Gen. Arthur C. Trudeau, have reminded Congress that the law in the National Aeronautics and Space Act and that the very technical aspects of its provisions have been badly neglected in the heavy emphasis on space research. There has been a tendency at the highest levels of both the Defense Department and the National Aeronautics and Space Administration to dismiss the need for any further astronomical research effort and to concentrate the budget-hunted research funds available almost exclusively on space and aviation. The character of this trend was detailed by ALAN WINKA, space technology editor, *Everett* in our issue of Nov. 30.

## Dangerous Course

We agree with Adm. Hayward and Gen. Trudeau that further pursuit of this policy regarding continued astronomical research in vital areas to denote the development dollar available almost exclusively to aviation and space is a technical folly and a dangerous course to pursue.

The former National Advisory Committee for Aeronautics established the first astronomical research facilities in the world at its Langley, Ames and Lewis laboratories. These were supplemented by special Navy and USAF facilities. Existence of these astronomical research facilities and their rigorous use made possible the world leadership of this country in the era of aerospace flight and the jet era of transport aviation, an extremely valuable military, economic and political asset in the modern world. The National Aeronautics and Space Administration, which absorbed the old NACA, its research facilities and talented technical personnel, still has, under the law, a continuing responsibility to provide astronomical research for both military and civil requirements. In view of the austere budget provided by the President and

Congress at the same time current space requirements were added to its astronomical foundation, it is only natural that NASA has used these limited funds primarily for its top priority space missions.

However, there is a continuing need for astronomical research for both military and civil requirements in such areas as supersonic VTOL vehicles, short takeoff and landing devices, helicopter, supersonic transports, new forms of propulsion and a variety of other fields where astronomical vehicles will continue to play important roles. In reviewing the act of 1958, Congress should make adequate provision to encourage this vital research freedom of NASA and prevent it from going on the verge of a budget apoplexy. If this happens, we will seriously squander a priceless national asset that will have serious repercussions in the defense picture and the civil economy.

## Liaison Problem

Some better solution than new axioms must be found for the military-civil liaison problem in the space picture. Any steps toward an effective solution of this problem have been hampered by the basic fiction presented by President Eisenhower in the foundation of our national space policy. First, the fiction that our current space research program is devoted wholly to scientific goals and, second, that there are no military applications for space research. Until these fictions are replaced by facts and a more realistic view given at the top level of space policy setting, it will be difficult to find a better working arrangement between the military groups with clear space requirements and NASA.

Another major consideration in solving this problem is that it be done with a minimum of organizational reshuffling or staff augmentation. NASA already is well over its head in organizational problems caused by absorption of other agencies and its own growth while the military services appear to have successfully effective organizations within their own framework for executing their specific programs. Any major organizational shuffle will simply climb to further delay into an effort that already has inflicted too much on the scene.

On the organizational front, the combination of the current House and Senate space groups into a Joint Congressional Committee of Aeronautics and Space preferred after its atomic energy joint committee would provide more effective handling of this technical subject than is now possible.

But more than any legislative changes the space program in both its civil and military aspects still suffers primarily from a lack of clear-cut national leadership and the uncoordinated establishment of superiority as its goal. Until this is forthcoming, any legislative patchwork, no matter how helpful, will not fully solve the problems of getting a national space program into high gear and keeping it accelerated for the long pull ahead.—Robert Holtz



## Convair 880 shrinks weight with new type B.F. Goodrich zippered panels

The target of the designers of the Convair 880 was to make the ship the fastest jetliner. Then there appeared rubber panels, used in both fore and aft cargo sections, had no scored, sliding types in strength/weight ratio.

A new construction by B.F. Goodrich provided the answer. The panels have the lowest weight, meeting strength requirements, of various designs ever sold. The material is very tough—a special rubber, resistant to oil, gas, or water, on glass fiber fabric. Most reinforcing edges are built for high load factors.

Some 25 of these panels are used in the 880 to seal the compartments against air or fuel vapor, yet permit instant access to concealed equipment. Color is white to provide good light reflection, cleaning is easy.

B.F. Goodrich has outstanding experience in fabricating zippered panels for sealing—airframe compartments, air ducts, access ports, and other uses. For technical assistance, check with B.F. Goodrich Aviation Products, a division of The B.F. Goodrich Company, Dept. A1F-38, Akron, Ohio.

The B.F. Goodrich Zipper designed with a provision to tie the rubber lips to make a tight seal, even around curves and corners. Opens quickly. Like an ordinary zipper—pulls back on lip ends, gas or fuel out.



# B.F. Goodrich aviation products

## WHO'S WHERE

### In the Front Office

**William Littlewood** and **Dr. Frederick Lindholm**, elected directors of the Visnaghi Corp., Van Nuys, Calif. Mr. Littlewood is vice president-engineering responsible for systems, Avionics, and Dr. Lindholm is chairman of the Division of Civil, Electrical and Mechanical Engineering and Architecture of the California Institute of Technology. Also Ross Alan A. B. Mather (USA, ret.) elected a vice president of Visnaghi and appointed general manager of Cooper Development Corp.

**Ed. Lee James M. Green** (USA, ret.), president, Arthur D. Little Inc., Cambridge, Mass., succeeding **Leonard Bennett**, now chairman of the Visnaghi Committee.

**David B. Nelson**, president, Kellogg International Corp., Chelmsford, N. Y., succeeding **Victor E. Calverton**, retiring.

**Ernest David**, president of the newly established **Boeing Pacific Inc., Anaheim, Calif.**, succeeding of **Boeing International.**

**Burt J. Kitchin**, president, Houston Fuel Co., Los Angeles. **Carl**, succeeding **George E. Johnson**, now chairman of the company's committee. Also **Richard Weber**, vice president-finance and vice chairman of the board.

**North American Aviation Inc., Los Angeles, Calif.**, has appointed the following general managers in positions of their respective divisions: **J. G. Borer**, Aircraft Division; **E. K. Hoffman**, Rocket/Propulsion Division; **Raymond H. Kott**, Los Angeles Division; **Chambers E. Smith**, Aircraft International; **Will H. Yale**, Calabasas Division. Also the former assistant general manager has been designated executive vice president and other divisions vice president have been created as follows: **Manuel Deane**, H. R. Rutter, executive vice president; **Dale D. Myers**, vice president-engineering; **James T. Cunningham**, vice president factory manager; **Karlheinz G. W. Gray**, executive vice president; **G. F. Dineen**, vice president research and engineering; **J. F. McNamara**, vice president liquid propulsion operations; **T. E. Myers**, vice president solid propulsion operations; **Robertson S. W. Harwick**, executive vice president; **E. M. Ashby**, vice president aircraft and engineering; **E. L. O'Neil**, vice president-control systems; **R. F. Holston**, vice president marketing; **R. F. Rose**, vice president test and test system product division; **C. A. Ward**, vice president aircraft light controls product division; **N. F. Fisher**, vice president computers and data system product division; **E. A. DeLeon**, vice president industrial products division; **Los Angeles division—Ralph H. Reed**, executive vice president; **Harmon A. Stearns**, vice president chief engineer; **W. F. Keating**, vice president manufacturing; **Alvin E. Leonard**, W. L. Longene, vice president administration; **A. E. Viorin**, vice president sales; **William Lloyd**, vice president technical; **J. J. Flaherty**, vice president planning; **Colin David**, **William R. F. Wilkin**, executive vice president; **George Giddens**, vice president and chief engineer; **S. G. Clark**, vice president factory manager.

(Continued on p. 106)

## INDUSTRY OBSERVER

Boeing, General and North American Aviation are three of the industry firms that have submitted analyses to the Air Force under Study Requirement 199 for a three-generation ballistic missile system with technical guidance and a probable range of at least 5,000 mi.

Pratt & Whitney JTF10A-1 turbofan engine, smaller member of the J87 family with 8,250 lb thrust (AW Sept. 28, p. 49), has won Navy's competition for a powerplant for the submarine-launched Minuteman II to be used as a launching platform for the Navy-Boeing-Genova Eagle solid-rocket missile.

Bids for the Minuteman airframe (AW Nov. 9, p. 12) were submitted late last month by Boeing-Wichita, Chance Vought, Douglas, Genova, McDonnell and North American Aviation. Pratt Navy document is not expected before May 1.

Next Atlas test of the Minuteman capsule will launch a McDonnell capsule in an engineering evaluation of the handling characteristics designed to compensate for heating. Capsule will not be fully equipped with production-model internal systems, some of which are being tested development schedules. McDonnell capsule also will be tested in the one remaining Little Joe launch from Wallops Station, Va.

Test bearings are being made for the second 75 units of the total of 150 selected for Minuteman solid-propellant ICBM sales in Minuteman. Work is being approved by Prime, Lockheed, McCauley, & D'Onofrio, Los Angeles architect and engineer. Bids for civil construction will be called by in June, Corp. of Engineers' Seattle District after soil and other tests have been completed.

Vehicle selected early warning satellite reportedly is being pushed ahead at the Space advanced reconnaissance system because of State Department reluctance to emphasize the reconnaissance-type satellite system and in the latter. First Minuteman vehicle will not be fitted with the specific infrared equipment planned for the operational version.

Civil studies under Study Requirement 192 of a lunar bombardment base requirement will be made at USAF's Ballistic Missile Division in Aeronautics, North American Aviation and Douglas only next month. Written proposals should have been submitted to the Air Force.

Latest development in negotiations between Allison Division of General Motors and Rolls-Royce, Ltd., for a possible licensing agreement between the two firms (AW May 25, 1978, p. 23, Mar. 7, p. 27) now lead to Allison's purchasing of the high bypass ratio RBK 963 in that country. AER 963 is a development of Rolls' RB 163 in the J2,800-lb thrust class.

Initial production model of the North American T-99 Sabreliner multi-purpose jet trainer is scheduled to roll off the line at the end of April with full flight scheduled for early June. Prototypes will be built Pratt & Whitney (late with approximately 1,000 lb thrust each. Total of 42 or more are now scheduled for the Air Force. At least 15-18 will be equipped with North American's steady and range order navigation equipment for training use.

Next Atlas ICBM training launch from Vandenberg AFB, Calif., probably will be made from Douglas 65-2 when the missile is stored in a horizontal position and directed for launch by a true structure rather than the multi-transporter and gentry tower system used at Cape Canaveral and Vandenberg's Complex 65-4.

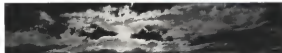
Aviation General has won a \$681,000 Navy contract for development of a hybrid engine for missile applications. Total of seven companies had submitted bids in the competition.

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computers that pace man's expanding mind



## Washington Roundup

Political observers expect President Eisenhower to make another swift effort to convince the public his defense policies are adequate. Effort may be similar to the Oklahoma City speech he made to allay public fears following Sputnik. Ideas drawn from the collection of top Republican strategists that defense will be a major campaign issue.

Republican politicians tell the President he will have to ask no more than his military supporters to support his defense stand. They talk of achieving as much possible divided control, as possible to get more facts on the record in support of the Administration position.

Vice President Richard Nixon undoubtedly will have an important voice in setting Republican strategy on this issue. He will have to run on the Administration record and he will want to make sure the Republican position on defense is as strong as possible.

Top Republicans in government and Congress will be marshaled to take the blame for the Administration line. Defense Secretary Thomas Gates, NASA chief Keith Glennan and other military and space officials can be expected to spin the best on the speech record supporting current policy.

### Bumare Showdown

First big showdown in the developing arguments over Bumare will come May 29 when the House Appropriations Committee meets in a special closed session with the Air Force to discuss the program. Congressional action for canceling the Bumare program has been rising in the wake of a series of Bumare-B test failures. House group wants to end the test which some last year cut Bumare and Nike, but the committee can be expected to cut the \$421.5 million requested for Bumare this year.

An Force will stick with the Titan program regardless of current test problems. Cancellation of Titan would reduce the 1960 ICBM force planned on launch about 50% in the current 1955-64 period and it is too late to accelerate the Atlas program to fill this gap in the required force period.

### Space Debate

Proposals for abolishing the National Aeronautics and Space Council and the Civilian-Military Liaison Committee (see p. 30) are in for tough vetting in Congress. Liaison committee was written into the Space Act by the House and House members don't like the act. It has been in power in NASA Defense Department relations. House now expects a substitute for the Liaison group, perhaps a group similar to the committee established for military AEC liaison.

There is little enthusiasm on the Senate side for getting rid of the Space Council. The committee was created at Administration request as an advisory group to the President in place of a space board to study and the national space program. If it should be abolished, there is strong feeling in the Senate that a space, civil or space, board should be established to replace the council and run both military and civilian space programs. Such a move would undoubtedly have the backing of tough space agency advocates.

Congressional fight also is brewing over tightening of conflict-of-interest laws. Legislation proposed by the House Armed Services Committee is considered widespread in other House members. Committee bill would take retirement pay away from officers willing to join reserve service rather than leave of retirement. This is similar to present USAF and Army rules, less stringent than Navy rules.

Senate hearings on national police machinery will turn next to the problem of leadership in the development of weapons systems. Government Operations Subcommittee, headed by Sen. Henry M. Jackson (D-Wash.) will study the leadership problem in the second phase of the study of police machinery which earlier produced criticism of the type and organization of the current defense effort.

### British Bilateral

U.S. and British delegates broke off bilateral negotiations in Canberra last week and went home for consultation after making limited progress on major issues. No final decisions were reached, but substantial progress was made. Negotiations will resume in Hong Kong and to negotiation of Caribbean treaties. TWA's long-sought Frankfurt Zurich link got only slight attention. Poor conversations from Canberra prompted confusion with Washington and London during discussions.

J. Gordon Bennett will leave his job as special assistant to the FAA administrator to accept his new position as director of the FAA's research and development division. Bennett will be replaced by J. Gordon Bennett, Jr., who is currently in the United States. Bennett will be replaced by J. Gordon Bennett, Jr., who is currently in the United States. Bennett will be replaced by J. Gordon Bennett, Jr., who is currently in the United States.





This proposed package consists of an eight-foot cylinder oriented around a central cylinder and shielded by a thin layer of lead. It can detect gamma rays of high energy radiation in the presence of ambient secondary particles. A similar instrument on Explorer VI identified an unexpected high energy radiation band near the inner corner of the great nebula belt surrounding each.

- **Ionization chamber and Geiger-Mueller tube** developed by Paul John Winkler at the University of Minnesota to measure total radiation from equipment. Instruments are particularly sensitive to modern energy radiation. Ion chamber will provide particle energy information, and the Geiger-Mueller tube will count the number of medium energy electrons and positrons passing through. Total weight is about two pounds.
- **Search coil magnetometer** developed

by David Judge and Malcolm McLeod of STL, to determine strength and direction of magnetic fields.

- **Aspect indicator** developed by Stuart Heller and George Tsalikis of STL. This photoelectric cell will record any direct looks at the sun to help determine direction from which magnetic fields and radiation are emanating.
- **Magnetosensitive counter** developed by Maurice Cohen, now at NASA, and Herbert Cohen of Air Force Cambridge Research Center to measure the mass loss and composition of all cosmic particles striking the probe.

#### Temperature Regulation

Temperature is regulated by a pass system on the payload's surface and by silicon heat sinks and active resistance material in the vicinity of the 178-watt transmitter and its d-c-d-c converter. Temperature stabilized in

the first few days of flight at about 75°.

Probe V was the first U.S. space probe to carry a digital telemetry system into deep space. It uses the Telemetry described by American Wire last Sept. 14 (p. 41), which was first used on Explorer VII launched last August.

In addition to its scientific instruments, Probe V will provide additional information of the Astronautical Unit, a broad-based communications network based on the cosmic distance from earth to sun but is not known to more than 50,000 mi accuracy. A check at the Astronautical Unit is not considered a major component of the probe, however, and tracking is not expected to be required.

Refinement of the mission will be attempted on some future probe when project tracking resources are available.

connect and return members at a level above both the NASA administrator and Defense secretary to handle policy, to direct negotiations and coordination and to resolve divergent programs.

At the same time, he said he felt it would be necessary to create a Military Liaison Committee similar to the one which now functions between the Defense Department and AEC with complete authority to review all of NASA's programs with an eye to military requirements.

While the set extended along this line, Adm. Harwood said it also would be helpful if Congress would create a Joint Congressional Committee on Astronautics and Space patterned after the Joint Committee on Atomic Energy. Lt. Gen. Arthur C. Trudeau, chief of Area Research and Development agreed with Harwood that there is a continuing need for astronomical research and further strengthening of its organizational structure. All of the national space program had deflected as to the world in one instance.

There is a necessity for a competent counsel, similar to that which directed NASA, he said, to guide NASA's civilian space program. He added, however, that the development of military capabilities for space missions required for security in defense, should be the primary responsibility of the Defense Department.

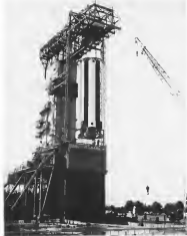
In closing the set, Gen. Trudeau said the Defense services should be given complete authority to proceed as much as any space project he feels necessary to the security and defense of the U.S. Then, if the NASA administrator failed to agree, then should go directly to the President to resolve their differences rather than to an arbitration council.

As for cooperation and coordination in foreign fields, Gen. Trudeau said he always has had "very close" links with the relationship that has been established between the Defense Department and AEC through the Military Liaison Committee and the Military Application Committee and some would be the establishment of similar committees to function between the DOD and NASA.

With the creation of the Civilian-Military Liaison Committee originally established to provide coordination, he said "the only permitted channel will be directly between the Defense secretary and the NASA administrator. While this is appropriate for providing proper policy, neither it will be parallel for the free exchange of more routine information and requirements."

In a letter to the committee presenting the Army's views on the proposed changes, Army Secretary William B. Franke also strongly urged the creation of a Military Liaison Committee.

Continued on the second page



**Saturn Booster Mounted in Static Test Stand**

Scram I facilities. Its booster is placed on 177 ft static test stand at Huntsville, Ala. Former Army test facilities there allowed NASA to develop the Saturn I booster. President Eisenhower named the facility the George C. Marshall Space Flight Center in honor of the late soldier statesman.

have a continuing and expanding responsibility to make use of the space program, it is essential that military needs, as well as military developments, be made known to NASA, and that such needs be made known to keep in touch with the progress of NASA's activities.

To have no regular and established channel for advice, consultation and coordination between the Defense Department and NASA, would affect the capabilities of each organization to be cognizant of objectives.

The existence of such a Military Liaison Committee would help to coordinate the full range of military requirements and that the attempt to create the committee in any committee has proved to be an "unreasonable, unfeasible and unworkable mechanism."

of important information in the national interest.

Earlier T. Keith Glavin, NASA administrator, told the committee that if the Space Council is eliminated, he will appear to ask many committees to meet the agency in drafting its plans and programs. He said it could be composed of representatives of the state, life, field, government and of private industry and would not only be an advisory capacity, but be responsible for the space program.

As for the Civilian-Military Liaison Committee, Glavin said it is a requirement that NASA (Defense Department) be considered at many levels and that the attempt to create the committee in any committee has proved to be an "unreasonable, unfeasible and unworkable mechanism."

#### Space Technology

## Additional Space Act Changes Proposed

**Washington**—Additional legislative changes going beyond those proposed by President Eisenhower to improve the National Aeronautics and Space Administration were urged by Defense Department officials and service representatives in testimony before the House Space Committee last week.

Witnesses generally supported the President's recommendations to abolish the National Space Council and Civilian-Military Liaison Committee (AWR 18, p. 35) but they felt additional improvements are needed if the proposed amendments are to strengthen their purpose.

#### Suggestions Offered

Suggestions offered included:

- **That the Space Council** be eliminated and replaced by a committee in house, similar in function to the group that headed the former National Aeronautics Committee for Aeronautics be authorized and be held responsible for all national space programs.
- **That a Military Liaison Committee** and a Military Application Committee be authorized after the committee are created to conduct liaison between the Defense Department and Atomic Energy Commission be authorized for the Civilian-Military Liaison Committee.
- **That an Activities Coordinating Board** be authorized for the Civilian-Military Liaison Committee with the NASA deputy administrator and Defense Department's director of research and engineering as co-chairmen. There would be several by NASA and Defense officials associated with special

areas in which coordination is needed, such as launch vehicles, life sciences, astronomy and periods of orbital interest.

• **That Congress create a Joint Congressional Committee on Aeronautics and Space** to replace the House and Senate standing committees.

Defense Department views were presented to the House Space Committee last week by Rep. Charles Braden (D-La.) by Deputy Secretary James H. Douglas. In support of the proposal that the Civilian-Military Liaison Committee be eliminated, Douglas said:

"I am convinced that the vast effort now coordinated by agencies and activities between NASA and the Defense Department can be accomplished by direct communication between those having management responsibilities at national levels and in particular areas."

To improve coordination at national levels Douglas suggested the creation of the Activities Coordinating Board. He said the board would be authorized to coordinate with the Administration, and Defense Department "fully and currently informed" with respect to all space activities and for the more efficient utilization of resources.

Such a board, he said, would be on a level below that of the NASA administrator and Defense secretary, but above that of all other working groups or divisions.

Adm. John T. Harwood, director of naval operations for development, supported the proposed changes as "an improvement over the present bill" but also said additional improvements could be made.

Adm. Harwood said the proposed system on coordination and cooperation might be improved if it were enlarged to report that:

- **The National Aeronautics and Space Administration** be empowered to initiate new needs in aeronautics.
- **The Defense Department** make available, as practicable, the military applications having potential application to space.
- **The two agencies** make maximum use of existing military facilities.

#### Air Research Log

Because of NASA's emphasis on Space since 1958, Adm. Harwood told the committee that aeronautical research has been "going down the drain." (For details of NASA's shift away from aeronautical research, see the Nov. 30 issue of American Wire, p. 26.) Harwood added that this was one field in which the U.S. is clearly behind and that it should not give up its leadership. He said the committee should consider research activities that are funded at the same level as in the past.

D. Harwood told the committee that he had requested and had received Defense Department approval for construction of a hypersonic wind tunnel at a cost of \$21 million, to be the research gap but that, when the proposal reached the Budget Bureau, it was delayed on the grounds that it duplicated NASA research.

So long as two space programs are in effect in the national effort—military and civilian, Adm. Harwood said he felt such problems could be discussed with a committee composed of military, pre-

# Increase in Atlas, Polaris Funds May Be Asked by Administration

By Katherine Johnson

Washington—U. S. Defense Secretary William B. Cohen Jr. indicated last week that the Administration may soon ask Congress for funds to increase Fiscal 1991 procurement of the Air Force Convair Atlas ICBM and the Navy-Lockheed Polaris fleet include similar funding. Cohen's statement came in the Senate's Preparedness Investigating Subcommittee and Space Committee. Cohen said the Defense Department is "contemplating" augmentations of the two programs. He said USAF and Navy have submitted to him proposals outlining various methods of accelerating the programs. Cohen's statement confirmed earlier reports that the Administration is studying the possibility of a request for Fiscal 1991 defense spending (AW Mar 18, p. 25).

The Administration's Fiscal 1991 budget now under consideration by the House and Senate Appropriations Committees provides for 17 squadrons of 18 Atlas missiles each and for three Polaris-equipped nuclear submarines.

Last year, Congress voted funds to purchase 17 Atlas squadrons, but Defense Department is buying only 13 Atlas squadrons. Navy voted for one Polaris submarine in the Fiscal 1991 program and got three.

Cohen said he was considering placing more Atlases at sites already authorized. Any additional Atlases ordered probably would be the long-range version (see p. 36).

Cohen observed that, in connection with the Atlas and Polaris programs, Defense Department also is reviewing related programs such as Titan and solid-propelled Minuteman ICBM projects.

Air Force has reported that Atlases ordered now or in the near future could start during the middle part of the end of 1992, at against only 1993 when Minuteman ICBMs were first coming into the service, he said.

Cohen also testified that a decision will be made within six months as to whether to move into production of the top-secretly Atlas missile warhead, satellite and development of the support aspects of the system.

Senate committee questioning was primarily aimed at clarifying Cohen's controversial interpretation of intelligence estimates to support his contention that the cost of the Atlas program will be substantially less than the three-times more estimated previously by former Secretary of Defense Neil McElroy (AW Feb. 1, p. 26).

In January, Cohen told the House Appropriations Committee "Secretary McElroy was operating on the basis of capabilities figures that produced, on a theoretical capability basis, something that was like three to one. This new intelligence estimate has narrowed the difference."

In last week's testimony, Cohen doubted that McElroy had ever made the three-to-one capability estimate. He said that a "secret group" appointed to the Department of Defense had been unable to develop that estimate, he charged.

See E. L. Burfield (D-Ala.) suggested that instead of establishing a committee to determine "whether McElroy was right or not," the Defense Department should be "called up on the telephone and asked Mr. McElroy."

Sen. Stuart Symington (D-Mo.) told Cohen that the three-to-one testimony of Allan W. Heller, director of Central Intelligence Agency, is a "direct contradiction" to the testimony of Cohen, and that the number gap will be greater

than estimated by McElroy, rather than less.

Gates declared to give his personal estimate of Russia missile superiority, concerning that it is "basically making out to get into sites and specific war heads" because they do not take into account factors such as accuracy, reliability, defense posture, hardening of bases. "I don't know how to summarize a ratio without causing more confusion," he said.

Committee Counsel Edwin L. West pointed out that the Defense Department has consistently underestimated its own missile requirements by wide margins and suggested that "you could be just as wrong in underestimating the Russian capability." The budget amounts requested by Defense for missiles, compared with the amounts which were ultimately purchased, for the past five fiscal years were given by West as: \$199 million requested in the 1986 budget, and \$125 million actually purchased; \$890 million requested in the 1987 budget, and \$1.4 billion purchased; \$1.9 billion requested in the 1988 budget, and \$2.1 billion purchased; \$2.4 billion requested in the 1989 budget, and \$2.9 billion purchased; \$2.5 billion requested in the 1990 budget, and \$5.3 billion purchased.

## Helicopter Sales Will Grow Tenfold In Next Decade, Hiller Predicts

New York—Helicopters sales in the U.S. will grow tenfold in the next decade, Stanley Heller, Jr., president of Hiller Aircraft Corp., said here last week. He also predicted a 75% increase in Hiller's conventional helicopter sales over during 1990.

Hiller's 1989 sales reached a high of \$16,211,624, a 28% increase over 1988 income, but were only \$4,850,000, or \$507,981 after taxes. Commercial and subcontract sales for 1989 were 33% higher than in 1988. Military sales rose up 12% over the previous year.

Building of civilian and commercial sales at the end of the year stood at \$17,011,000, of which about 511 million is military. Some \$7.8 million more worth of orders now is in the process of negotiation, according to Heller. To December, year-to-date sales are \$17,011,000, of which about 511 million is military. Some \$7.8 million more worth of orders now is in the process of negotiation, according to Heller. To December, year-to-date sales are \$17,011,000, of which about 511 million is military.

Rate of growth of the helicopter industry will be considerably beyond that of fixed-wing aircraft both in dollars and units, Heller said. Conventional aircraft, he feels, should eventually

attain mean speeds approaching 250 mph. A civilian market for VTOL aircraft should be here in five to seven years, he estimated, with a civilian market in five years. He believes the entire air transportation industry will reach saturation by VTOL.

Hiller's following X-15, undergoing transition tests at Edwards AFB, Calif., has been flown at up to 15,000 ft in the wing.

Full conversion, at 15,000 ft, will start within the next few days.

The company, also in building an experimental satellite system jet propulsion system, which is a contract from the Air Branch of the Office of Naval Research. Heller will run a full-scale hard-core strand within the next few months, using a 1,000 lb thrust engine. Practical limitations, such as vulnerability to fatigue short design, great weight, etc., have begun to play down the use of the ducted fan, according to Heller.

Hiller's first four-place helicopter, the 125-1, will roll off the production line this week. First delivery will be made this summer. Later this year company will flight test a turbine-powered 1123 prototype. The powerplant will be the T80 of 450 hp.



Lockheed JetStar on four-engine configuration as well as a company evolution program at Marietta, Ga. Engines are Pratt & Whitney JT12 turbojets (AW Feb. 25, p. 31) producing 1,000 lb thrust each. Dual wheel gear employs original single wheel system.

## Four-Engine Lockheed JetStar Enters Test Phase



JT12 turbojets mounted in pairs, weigh 450 lb. each and give the JetStar a 150 mph. speed. The three turbojets, containing 640 gal. each, push JetStar up to 2,500 mi. (AW Aug. 25, 1985, p. 77) into wing without a tank problem. Floor has been loaded with auxiliary wing loading gear and engine thrust reversers. First prototype used for corporate and military use is scheduled to fly in July, delivery to customers and test program. This prototype will leave for Edwards AFB, Calif., after its continued flight testing.



## Ranges Exceeding 10,000 Miles Predicted for Atlas-E ICBM

Washington—Ranges exceeding 10,000 mi. are expected to be realized by the Air Force-Convair Atlas-E interceptors against Soviet missiles, the model that will follow the current Titan as the first stage of the Atlantic Missile Range.

Some Atlas-Es are scheduled now to receive the Avco Mark 4 nose cone, originally proposed only for the USAF's Altair ICBM. This nose cone carries a warhead with considerably more explosive yield than earlier nose cones.

Range of an intercontinental missile varies with the model, the altitude reached and the direction in which it is fired. Normal range for the Atlas and Titan under original planning was 5,000 mi. or 6,125 mi. or less. This is limited, but the earth itself is flat. Due to the earth's rotation, firing in an easterly direction increases range, while firing in a westerly direction decreases it.

Improvements in the missiles themselves, the trajectories they must take and their reentry bodies have increased the potential range considerably above the original goals. Atlas-Es, for example, already is capable of reaching approximately more than 9,000 mi. on carrying the General Electric Mark 1 nose cone, which uses operational warheads will be.

Until diplomatic considerations in-

tervened, the Atlas ETD, which is planned recently at launch, had once been scheduled to fly for a 9,000 mi. plus range, carrying its reentry body to the Indian Ocean east of the southern tip of Africa.

Although an attempt was to have been made to postpone this test to counteract the propaganda effect of Soviet Russia's recent long-range missile firing into the Pacific Ocean, it is expected that the overall test schedule eventually will call for a shot of about 3,000 mi. range regardless of political considerations.

After originally was scheduled to carry the General Electric Mark 2 engine test-bed, nose cone used on the Douglas Thor intermediate range missile. It is possible that all operational aircraft will carry the Avco Mark 4, which also uses the same technique to combat heating.

Thrust of the Rocketdyne engines powering the Atlas has been improved from the usual 300,000 lb. total thrust to a planned 400,000 lb. for the E series Atlas (AW Feb. 29, p. 27). Other gains in range have been achieved by switching from conventional metal to a glass fiber shell around the first booster engines, by decreasing static engine start weight and by shifting engine locations at the aft end of the missile to

## NASA Contract Bids

Washington—Five companies bid last week for development of a 200,000 lb. thrust hydrojet fueled engine that will power two stages of the National Aerospace and Space Administration's Saturn space vehicle. They are Rocketdyne Division of North American Aviation, Inc.; Bell Aircraft Corp.; General Electric Co.; Pratt & Whitney; and Aerojet-General Corp. Two companies that attended the bidders' conference did not offer proposals. They are Thiokol's Rocket Motors Division and General's Rocket Motors Division. Contract is expected to be awarded in May.

Autodesk bidders for the S-4 stage of the Saturn last week began making verbal presentations to NASA. Written bids were solicited earlier by 11 companies (AW Mar. 7, p. 379). Contract is expected by Apr. 1.

Proposals for the three Altair test-bedder 1-100 engine collective system for use on Titan and Saturn vehicles already also were due late last week, and winners of the contract for the main engine components of the 30-ft-diameter Stage 6 nuclear powered system (AW Feb. 28, p. 38) was expected to be announced late last week.

Lockheed scored the engines through its Titan engine contracts will give the E model a range of from 3,500 to more than 10,000 mi., depending on the reentry bodies used.

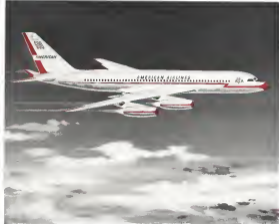
The Avco nose was designed to be interchangeable between Titan and Altair, it was more of the ICBM range weight, but until recently it had been programmed only for the Titan. Avco made its only flight aboard the Atlas ETD for six months, ETD left Jan. 26.

Another improvement acquired partly as a result of the Titan program, which was begun approximately a year after Altair, is a differential guidance. After test analyses led them for long, it carried a General Electric-Rocketdyne radio-inertial system, but the first Atlas reentry package took its initial checkout ride on Atlas ETD on Mar. 5 (AW Mar. 14, p. 35).

Prior to the all-inertial shot and the explosion of Atlas ETD, Atlas has made 44 flights, 75% of which had been successful, although, 19% partially successful and 7% unsuccessful.

## Second X-15 Makes Sixth Powered Flight

Los Angeles, Calif.—North American Aviation's No. 2 X-15 made its sixth powered flight last week. Tenth flight since Nov. 9, 1959, of which 4 runs were unpowered. Scott Crossfield piloted the vehicle.



## On American Airlines' New Convair 600s SP-30 FLIGHT CONTROL SYSTEM

When American Airlines' new General Dynamics Convair 600s go into service in 1961, passengers will travel faster than ever before—at a cruising speed of 635 miles per hour. To meet the demanding control requirements at this speed and to assure the ultimate in passenger comfort, American Airlines specifies Sperry's SP-30 Flight Control System—the system designed and engineered specifically for high-speed multi-jet and turbo-prop transports.

UNDER ALL FLIGHT CONDITIONS THE SP-30 ASSURES BETTER PERFORMANCE. From take-off to landing, the SP-30 assures smooth operation at all speeds. Control is accurate, precise and radar guidance remains close—no-weather landing approach controls are vastly improved. Integrated Sperry flight instruments give the pilot a detailed picture of the aircraft's position and progress.

Through specifying the SP-30 for its new Convair 600s, American Airlines

joins its ever increasing number of airlines giving their passengers greater comfort and greater assurance of scheduled performance.

**SPERRY**

AGGREGATION EQUIPMENT DIVISION, SPERRY GYROSCOPE COMPANY DIVISION OF SPERRY, 1000 CONVENT AVENUE, NEW YORK, N.Y.

## Mercury Capsule Delivery

Washington—Four McDonnell Mercury capsule refueling has been accepted by National Aeronautics and Space Administration's Space Task Group. A second capsule, fully assembled, now is scheduled to be received within 10 days.

First two capsules will have a progressive number of subsystems as flight. Test components for the first capsule are being constructed at the Space Task Group's Langley, Va., facility for further test work there. Configuration tests include leak tests, pressure tests, reentry tests, etc. Several additional flights of capsules around Atlas-D missiles are scheduled from Feb. 14 by the Air Force Missile Test Center. Decision on whether to launch the first capsule reached, which essentially was just an advance call, with the next Atlas-E to wait for a nose fully equipped capsule must be made soon due to tight launch scheduling at the Atlantic Missile Range. USAF wishes to launch one more Atlas reentry vehicle test vehicle from Feb. 14 before a Mercury that is made. One McDonnell capsule launching from a Little Joe vehicle also is scheduled from Wallops Island, Va.

Post-mortem of the explosion of Atlas ETD on Mar. 10 indicates that three signals could have been fed to the short timing system planned for the Atlas nose to the Mercury program as late as have safely ejected the capsule by means of the emergency escape system.

Seven Mercury space pilots will go to the Naval Air Station, Pensacola, Fla., late this month to practice dropping down capsules of size. On Mercury flights, capsules will carry life raft in case of landing outside designated recovery area. Astronauts will be required to wear prototypes of their Mercury pressure suits and to make use of life rafts. Reentry capsules constructed by NASA and the only McDonnell will have escape hatch, but the small one, but later production models are to have rectangular escape hatches on the capsule's main body.

FROM  
WAY  
UP  
THERE

# PROVEN PERFORMANCE\*

With Canadian Marconi Company's  
**DOPLER NAVAD**  
AIRBORNE VERSION

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2442 Trenton Avenue,  
Montreal 16, Canada.



## U. S. Court Denies ALPA Appeal On Pilot Age Retirement Ruling

New York—About 55 pilots were  
granted last week when an aircraft  
union filed appeal filed in the New York  
Pilot Age Ruling to stay the May 17  
effective date of Federal Aviation  
Agency's regulation forcing retirement  
upon older pilots at age 60.

"The pilots request for an injunction  
that would bar enforcement of the regu-  
lation, promulgated last December  
by Administrator F. Ray Oshinsky  
was denied by the U. S. District Court  
for the Southern District of New York,  
Sprinkle, through Judge Alexander  
Belko. The court refused to postpone  
the ruling's effective date pending an  
appeal by the pilots.

Within hours after the decision had  
been handed down, ALPA attorneys  
sought to reverse it in U. S. Court of  
Appeals which upheld the lower court  
but asked that the pilots could remain  
in force for setting aside FAA's age  
regulations before a three-judge circuit  
on May 8.

Earlier, an Air Lines association filed  
suit with ALPA in a motion asking the  
Court of Appeals to make final deter-  
minations of the relevant regulation's  
legality before allowing it to take ef-  
fect. The court's pilot for the suit was  
as reported by the court.

Earlier, which will line, eight years  
experience this was made by the age, which  
said that it was not to be forced to under-  
take, with training purposes for pilots  
moving up the company's career, but  
into the, several months from the three  
granted. The court did not have  
over make known its position on the  
basis of the FAA regulation.

ALPA's counsel told Associated Press  
there was much discussion would be filed  
with its appellate court and that both  
the pilots' association and the govern-  
ment would accept the age rule in  
April. In postponing its case in District  
Court last month (AVW 39, p. 47)  
ALPA contended that the regulation  
violated the constitution's equal rights  
clause, of those people  
rights, subject due process of law. To  
this Judge Belko responded.

An attempt to scrap the, counter-  
ruling consideration of dollars lost to  
the approximately 40 pilots who be-  
grantedly against the public safety as  
an excess operations burden on the  
air.

Conceding he had given previous  
help, Judge again referred to ALPA's  
motion that pilots' rights under the  
Fourth Amendment were being violated  
by the FAA regulation. He said that no  
evidence for this position that pilots  
had a vested right without loss in  
discretion, to fly aircraft transports could

be found either in the statute, creating  
the FAA or in the terms of the agency's  
decision issued to the government.

The pilots also asked with the admi-  
nistrator's title than ALPA because:  
• Airline industry, through the Air  
Transport Association, agreed that age 60 re-  
tirement is a "reasonable and practical"  
limitation which ATA would prefer to  
see adopted.

• Aerospace Medical Association supported  
the age rule.

• Chairman of the governing body of the  
Civilian Aeronautics Association, As-  
sociates Captain Harold P. Guggenheim  
backed the regulation. Judge Belko  
quoted Guggenheim as saying:

"There is increasing evidence that at  
most given pilots, this substantial  
experience determines which men  
have superior judgment and skill  
cannot compensate adequately  
where higher speeds significantly reduce  
the time available to conduct a se-  
quence of maneuvers in emergency."  
There is no doubt that most of these  
older pilots are successfully continu-  
ing their present service, and even  
make transition to other roles in com-  
pleting more aircraft, and rapid flight  
climb. But there will be the necessary  
one who cannot—and that fact must  
be discovered until there is a dramatic  
crash which may take more lives."

• Testimony of most aviation medicine  
authorities holds that aging does not  
affect pilots.

## News Digest

**For American World Airways, Inc.,**  
has received a \$15,521,551 Army con-  
tract to establish and operate a facility  
for surveillance, drone and electronic  
communications, situated at Army's Test  
Range Proving Ground, Fort Belvoir,  
Air. Testing will begin in approx-  
imately two months. Bell Aircraft's Amer-  
ican Division is principal subcontractor  
for the, awarded \$7.6 million for its  
part in the program.

**Quincy Engine Airways** has ordered  
three Boeing 707-138B transports in ad-  
dition to its original purchase of seven  
which have been delivered. The first  
new aircraft will be received with Pratt  
& Whitney JT12D turboprop engines  
and, later, the first seven will be re-  
fitted with the new powerplant.

**Lockheed** company-funded cap-  
tured helicopter crashed in a firm  
field near Newhall, Calif., recently, re-

## Comet IV Hits Hilltop

Madrid, Spain—British Overseas Air-  
ways Corp. de Bristow Comet IV jet  
transport, bound for London from  
Birmingham, made a night emergency  
landing at Estoril, August 10, after  
striking a hilltop on the downwind leg  
and recovering for a successful go-around.

The main gear was extended and  
skids were retracted two and a half  
miles. The landing, the last time was ten  
miles and the aircraft groundslowed  
around the left wingtip. The crew and  
25 passengers escaped injury.

The fuselage involved is 52,49 ft long.  
The accident was the second night  
landing mishap involving a BOAC  
Comet since Dec. 29 when a Comet  
landed on top of a house. The pilot has  
undergone disciplinary action.

Young Pilot Vaughn King, Helicopter  
operator, in a two place and his wife  
had control, emergency landing, for a  
collective pilot's control.

**Highway Test Co's Aircraft Division**  
will test the Douglas C-47A helicopter  
(Aero YHO 2001) at a civilian test  
facility, production at Collins City,  
Calif., now scheduled for 190-400 an  
eight per year. Price will be \$22,500.

The helicopter is powered by a 160-hp,  
O-460-210 engine of 158 hp (JAW  
Oct. 27, 1958, p. 38).

**Ignition failure** of the second stage  
of the Martin Jet-C, during its May  
7 firing from the Air Force Missile Test  
Center at Cape Canaveral Fla., has  
been attributed to the gas generator  
valve. The valve failed to open and the  
start sequence ran through its automatic  
cycle before either the gas generator or  
the combustion chamber started. Flammation  
of the valve has been under con-  
sideration for some time in a design  
improvement program for the engine.

**John H. Babel** was named last week  
to replace Dr. Howard A. Wilson as  
deputy director of defense research and  
engineering. Dr. Babel has served  
as assistant director of defense research  
and engineering (airframe research).

**Tenneco** aviation unit-airline aircraft  
was launched last week in its first full-  
scale flight from a Douglas A1D at a  
surface stage on the Pacific Missile  
Range test site.

**Emmett J. Goss**, vice president, fi-  
nance and treasurer of General Dynamics  
Corp., resigned effective May 31 be-  
cause of a policy difference within the  
company. The resignation came at the  
time, as the announcement of two  
new executive vice presidents including  
W. F. Callender, vice president-in-charge  
for the Westinghouse Co.

# AIR TRANSPORT

## Used Plane Market Soft, but Not Glutted

Airlines study new markets, uses for piston planes in face of aircraft price drops and high jet payloads.

By Glenn Garrison

New York—Widespread dumping of piston engine aircraft as the used plane market has not occurred although many experts were predicting this a year ago when the shift to jet operations began in earnest.

For a variety of reasons, as Aviation Week's survey revealed, airlines are phasing out their piston-powered fleets at a slower pace than had been widely expected. Among the factors affecting the current market:

- **Phase-out of low-horsepower piston planes** has declined considerably over the past year. An exception is the Douglas DC-4. Some aircraft, as the Boeing Stearman and Douglas DC-7, apparently are not suitable in the present market.
- **Credit rather than cash** is increasingly a requirement of aircraft selling, with well-built airlines less and less inclined to purchase equipment.
- **High-value releases** are enabled on aircraft with a long life after phase-out as an immediate payment, an option that previously was not available in the present market.

Under typical agreements reached in late 1958 and early 1959 (AW page 27, p. 42), Aero contracted to buy 10 American Airlines 240s and 45 of American's DC-6 series aircraft, with the planes to be phased out gradually, in a period of about three years. Aero also took full financial rights on the remaining 10 of American's DC-6 series planes.

### Two Deals

At that time, American had sold 25 DC-7s to General Aircraft and Leasing Division of Capital Dynamics Corp. in a buy-down deal connected with the purchase of Capital 600 jet equipment.

American, therefore, secured with these two major deals and the cargo conversion of its piston fleet well ahead of time.

In a new arrangement with Aero under the dealer unit American's U.S. and Canadian sales agent in fact as the DC-6 airplanes are converted and Aero is no longer committed to buy them. The Capital Dynamics division at the time the airline was in setting up its own sales agents to handle aircraft disposal in other countries around the world. A commitment has been made to make the program, and agents currently have been contacted in England and Japan, with Mexico to follow soon.

### Soft Market

While the present aircraft market is generally soft, the survey disclosed a belief in some industry quarters that used aircraft can be found in long-term piston transports have and productive for many years.

One of these sources because a new use of an aircraft in such cases is both America and Africa. The availability of used transports at depressed prices may be an opportunity for many countries to improve their air service.

It is generally conceded that some progress is being made in financing, marketing and meeting requirements with a wide variety of aircraft must be considered. The growth expected effort to develop the new markets.

Uncertainties and complexities of the current used aircraft market are illustrated by the recent negotiations

Frederick Auer sold Aviation Week that the used four-engine transport market had not developed as much as he expected a year ago. The selling market is uncertain, he said, and there is less availability of surplus aircraft than had been expected. Airlines are finding out that their piston planes, such as cargo conversions, which they had been planning to sell the same places.

In some cases a sale at depressed prices would be economically marginal and the airline would prefer to hold on to the plane. Some demand has been less than expected now, according to Aero. The "bidding demand" as it is called, but is not reflected in closed deals. Aero said, have now dropped to the lowest point that still attracts can be maintained.

### Financing Problem

Regarding the American agreement, Aero said he was into difficult financing. The airline is not to make any payment until the aircraft are delivered. In accordance with the demand of potential airline customers. The completion of this problem began with American's need for advance action that certain airlines would be phased out of the route pattern within a certain time. The customer, however, is having a difficult time deciding which aircraft and configurations will best suit his needs.

American can eight different DC-6 series models in various configurations and loads in different years, with varying amounts of cargo conversion.

Overhead time may have to be allocated to the prospect's maintenance facilities. In some cases airline prospects have taken to long to make up their minds that aircraft have been considered to be sold, the aircraft by the date delivery is required.

In other instances airlines actually have been pulled out of service and put back in operation. The program has changed his mind about what was needed. This complicated planning and pricing problem has caused headaches both to American and to Aero, the world sale.

As a result of a year ago now planning a worldwide expansion program to promote selling, leasing, financing and other used aircraft programs for foreign airports. This has not materialized because, Aero said, the market has not developed as he expected. Changes of some aircraft types on the future world market are possibly needed, Aero said. Much of the aircraft is a high

## Used Aircraft Prices

Current selling prices of used transport aircraft are compared below with selling prices a year ago. The prices are based on estimates by Aircraft Leasing.

Type	1959	1958
DC-4	\$148,000	\$158,000
DC-4	\$183,750-200,000	\$193,750-200,000
DC-6	\$18,000	\$20,000
DC-6A (long range)	\$300,000-350,000	\$310,000-360,000
DC-6B (long range)	\$150,000	\$160,000
DC-7	\$60,000-70,000	\$65,000-75,000
DC-7	\$120,000-130,000	\$125,000-135,000
DC-7A	\$18,000	\$20,000
DC-7B	\$18,000	\$20,000
DC-7C	\$18,000	\$20,000
DC-7D	\$18,000	\$20,000
DC-7E	\$18,000	\$20,000
DC-7F	\$18,000	\$20,000
DC-7G	\$18,000	\$20,000
DC-7H	\$18,000	\$20,000
DC-7I	\$18,000	\$20,000
DC-7J	\$18,000	\$20,000
DC-7K	\$18,000	\$20,000
DC-7L	\$18,000	\$20,000
DC-7M	\$18,000	\$20,000
DC-7N	\$18,000	\$20,000
DC-7O	\$18,000	\$20,000
DC-7P	\$18,000	\$20,000
DC-7Q	\$18,000	\$20,000
DC-7R	\$18,000	\$20,000
DC-7S	\$18,000	\$20,000
DC-7T	\$18,000	\$20,000
DC-7U	\$18,000	\$20,000
DC-7V	\$18,000	\$20,000
DC-7W	\$18,000	\$20,000
DC-7X	\$18,000	\$20,000
DC-7Y	\$18,000	\$20,000
DC-7Z	\$18,000	\$20,000

Note: 1-3549K set primarily on the market

involved and technical staff. Formulating the four-engine transport market—previously an airline market—has been difficult because, among other reasons, no data transactions will be in quantity, with six or eight airplanes a typical number of units. However, Aero reports his activity in some other places, in the DC-6 and DC-8, to increase his low-power settings and meeting the program in a way that would be impractical in a competitive situation where speed is more important.

American sold its DC-7 airplanes and had to pay to General Aircraft and Leasing Division at about \$350,000 per unit.

American, first domestic operator of its own jet equipment, has about 124 piston engine planes in a fleet of 191 aircraft including Boeing 707-120s and Lockheed L-1049H. The airline has sold seven aircraft, all of the DC-6 series, this year. It plans to sell 11 additional aircraft for sale this year, including DC-4s, DC-7s, and DC-8s.

### Executive Comment

Aero's statement at present is merchandising American's airplanes, he said. For the future, he focuses more on aircraft activities as the executive market and a general expansion of the four-engine piston market. But the company's expansion plans are in abeyance for the time being. Aero said, he is handling jet or turboprop aircraft is not expected in the near future.

None of American's 15 DC-7s sold by General Aircraft and Leasing has been sold, but 17 are in use in the Overseas National Airlines. The airline is in the process of selling

part Service contract work. One problem with the DC-7s could be several years in the future. Turbo-prop engines are being developed by the U.S. Navy and the U.S. Air Force. The U.S. Navy is developing a turbo-prop engine for the U.S. Navy and the U.S. Air Force is developing a turbo-prop engine for the U.S. Air Force. The U.S. Navy is developing a turbo-prop engine for the U.S. Navy and the U.S. Air Force is developing a turbo-prop engine for the U.S. Air Force.

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American plans a flexible approach to marketing its surplus planes. Regarding financing arrangements, a spokesman said the airline is "willing to accept almost any form of payment."

None of American's piston airplanes is in use here, but it's open for sale. The airline is in the process of selling part Service contract work. One problem with the DC-7s could be several years in the future. Turbo-prop engines are being developed by the U.S. Navy and the U.S. Air Force. The U.S. Navy is developing a turbo-prop engine for the U.S. Navy and the U.S. Air Force is developing a turbo-prop engine for the U.S. Air Force.

all 11 are covered by an option to purchase.

Aside from the above and a DC-8A leased to Frontier, the American Airlines fleet is about the same as it was prior to introduction of jet. It includes Stearman, DC-7B, DC-7C, DC-6A and various DC-4 configurations. The company said that the use of jet piston aircraft is used in a high demand for service and a credit facility that makes it possible to shift aircraft to the best use.

Trans World Airlines, a jet operator since last March, now owns a fleet of 15 Boeing 707-120s and five 707-310s. It is scheduled to receive seven more International and 38 Boeing 707-310s. The disposal of its used aircraft is the responsibility of West Coast Airlines, which has been handling this job since last May.

TWA has disposed of 34 aircraft, most sold outright and some on lease-purchase arrangements. Some of these planes have been delivered. Transactions include the sale of DC-4 cargo aircraft, sale of seven Martin 202s and 18 Martin 404s, sale of one Lockheed 1449 Constellation and one TWA Constellation. The airline has also sold 10 Lockheed 1449 Constellations and one Lockheed 1449A, sale of one and loss of one Lockheed 1449G.

Sale of one 1049A is now being negotiated. It was sold outright and includes 17 Lockheed 1449As, which at present are not being sold. The airline has also sold one DC-4 cargo airplane in need for more support and is not on the market. Eight 1449As are available. Twenty-one 1449As are not being sold because they are not suitable for sale.

### Realistic Pricing

Robertson, president of the airline, said that the airline is in the process of selling part Service contract work. One problem with the DC-7s could be several years in the future. Turbo-prop engines are being developed by the U.S. Navy and the U.S. Air Force. The U.S. Navy is developing a turbo-prop engine for the U.S. Navy and the U.S. Air Force is developing a turbo-prop engine for the U.S. Air Force.

Recent and future prospects for the used aircraft market, as viewed by an aircraft leasing specialist in discussions with Aviation Week, are summarized as follows:

William C. Wald Associates transport specialist looks. There will be an excess of surplus now owned in the four-engine category, and piston will be in excess. The airline is in the process of selling part Service contract work. One problem with the DC-7s could be several years in the future. Turbo-prop engines are being developed by the U.S. Navy and the U.S. Air Force. The U.S. Navy is developing a turbo-prop engine for the U.S. Navy and the U.S. Air Force is developing a turbo-prop engine for the U.S. Air Force.



group" or "was" and that extend military discipline to transportation personnel and corporate management as well as to the flight crew. He said the legislation that must take into account that the boards of a carrier now will be difficult to do.

On the question of transportation of MATS airlift by commercial carriers at the Air National Guard, Gen. Tamm said, "I am interested in having people who are completely and absolutely separate to us, and to do what they are told, when they are told, how they are told, and people are trained to respond under combat conditions."

"So, ideally, I would prefer this guy to be left by military aircraft."

The importance of an airlift contract to the Air National Guard, Gen. Tamm said, is "an outgrowth step" because it "places transportation under positive military control and discipline." He added:

"In the future, we can bolster our military organizations by incorporating our units of the Air National Guard or Reserve and by assigning them to transport aircraft as they place out of active Air Force operation."

The current C-7's in the Guard program at \$160 million had a maximum of 1,600 aircraft. In capacity, at \$130 per unit, conversion cost per plane will be approximately \$20,000 to \$25,000.

Gen. Tamm said the 115 cargo aircraft now in MATS' Civil Reserve Air Fleet are "trained and outstretched."

DC-7s, Constellation and DC-7s. He said MATS plans to reduce its allocation of cargo traffic to commercial airlines from 115 million ton miles in Fiscal 1960 to 71.6 million in Fiscal 1961. Sea. Monitors disrupted Gen. Tamm's remarks upon board airlift control legislation before they are taken to develop commercial cargo airlift.

"We won't be able to pluck planes out of the air because we have legislation when there are no planes there," Macrone said.

Gen. Tamm said "the job of the civilian airlines is to go out and get commercial business and, finally, to come in to the Department of Defense to get all the business they want to build their airplanes. I think there is plenty of it if they had the right airplane, and they could get their prices down."

Encouraging the purchase of modern aircraft by the airlines, Gen. Tamm reported that MATS is considering a revision of its contract specifications to request straight in-loading, long-range reliability equipment and an extension of its present two-year contracts to three or more years.

He briefly supported commercial use of competitive bids on MATS contracts. He said that MATS, like the other, obtained a major transportation of its commercial capacity for \$59.5 million under competitive bidding, which would have cost \$116 million at the lowest common carrier rates available at the time.

petition in leading domestic trunkline airlines, but the Board should not get further involved in parallel state airline contracts where jet aircraft may be used with the impact and experience of jet service has been gained.

CAB should relax its controls on airline scheduling, eliminate or reduce any duplication of routes between trunk and local, authorize bond-structure contracts to serve other air communities and motor operators and expedite action on requests to provide air motor service in any point where rail passenger services are being abandoned.

Legislation should be enacted permitting CAB to allow more carriers to explore the possibilities of developing a defined area air transportation market through "airlift loss-fight" in high traffic density markets.

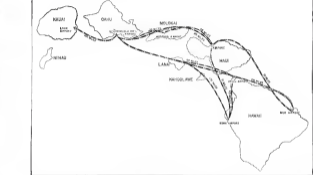
Subsidy payment formulas should be changed by legislation to achieve air domestic trunk carrier from subsidy eligibility after five years of unaided free operation. Subsidy payments to local service airlines should be based upon the new awarded cash recovery rather than the current needs, and CAB's air motor policy should be "logically adjusted" to ensure that no controlled service is provided.

International air travel trends should be watched carefully. CAB should encourage international carriers to reduce fares as rapidly as possible, but the Board should not be granted additional power to fix international rates at this time. At the same time, a long-term analysis of trends in the international field should be prepared by the Secretary of Commerce to determine the future participation of U. S. flag carriers in the market. State Department also should increase its negotiations with foreign air carriers whose operations seem to conflict with existing bilateral agreements.

• Status of domestic airway mail privileges should be established under new legislation to reduce present and contemplated gate fees plus similar fees on low-cost-basis jet fuel. Commerce also should begin a thorough study of airway costs.

• Federal Aviation Agency should begin a series of studies of airport construction, improvement costs and benefits, financing, operating costs, and airport construction and ability of airport costs to pay federal and local landing charges or well as alternate methods of charging. The review and such new charges are not to be confused with new taxes on aircraft.

• Defense Department and other branches of government were urged to continue the use of commercial air services where practicable. The survey also requested that the Department of government guaranteed loans for cargo plane purchases.



MAP SHOWS complete route structure of Aloha Airlines scheduled service. Routes profile those of Hawaiian Airlines to meet the steep competition that exists between the two carriers.

## Aloha Credits F-27 for Traffic Gains

By L. L. Davis

Honolulu—Aloha Airlines established a firm foothold last year as an island carrier on the new state of Hawaii after more than 12 years of search and struggle with its sole competitor—Hawaiian Airlines.

Until last year the pitched battle between the two carriers has been confined with Hawaiian traditionally enjoying a lion's share—on average of 73% of all interisland traffic. However, in June Aloha added three F-27s to its fleet, and by the end of the year the battle between the two carriers immediately narrowed.

Aloha's present success is attributed by its president, Robert C. Chang, directly to the F-27s. Hawaiian discounts his disbeliever that any one aircraft would have brought about a more equitable distribution of traffic between the two carriers.

Nevertheless, this is what Aloha has achieved in a single year:

- Aloha's share of interisland traffic during the last six months of 1959 outstripped from a normal average of 19% to more than 51%. For the year 1959, Aloha's per cent of total traffic doubled to 39 from 22 in 1958.
- Financial representation during the

year brought net worth up from a \$41-625 delinquency as of Dec. 31, 1958 to a net worth of \$1,505,077 for the same date of last year.

• Net profit for the year amounted to \$94,187 as compared with a 1958 net loss of \$43,911. Hawaiian Airlines reported a net profit of \$7,146 for 1958—down from \$10,541 earned the previous year.

• Aloha reported free of subsidy last year and does not now anticipate a subsidy award, although it has asked the Civil Aeronautics Board to keep it as an open case. Hawaiian Airlines was forced into requesting subsidies totaling \$108,120 in 1958. Board refuses to pay this claim could create a net loss for the carrier for the year.

### Traffic Potential

This latter struggle for traffic to retain the two carriers, with effort on the other outlying islands, again focuses sharp attention on the basic question of whether the state of Hawaii can economically support two carriers with routes paralleling one another.

One question is particularly raised by CAB rates concerning interisland air transportation, but it was not much mentioned in former Board Member Gerald R. Bazz as he projects

only predicted in a dissent from a 1953 decision giving Aloha the right to serve, and that service could repeat without subsidy for any length of time. He said:

"In a very small village, the market size is so small that it will not support reasonably one, special stage of a competitive carrier. The business, both firms will suffer losses which will be fatal to both. The case thing is true in air transportation."

Despite this problem, both carriers are here to stay. Aloha is doggedly determined to compete on equal grounds with larger Hawaiian Airlines and is now in the process of adding three more F-27s to its fleet, all of which will be its scheduled service that year. Hawaiian is vigorously seeking transoceanic routes (AW Nov. 16, p. 45) to augment its interisland routes in the only means of raising revenues which might begin to place the company back on an even keel.

Meanwhile, the Bank of Hawaii, in a detailed economic study of the island's potential, has projected a growth picture that should be reflected in a substantial increase of air travel traffic to provide more opportunities for both airlines. The study predicts that the number of tourists visiting Hawai-

## Less Federal Regulation Urged In National Transport Survey

Washington—Miscellaneous airline transportation independence combined with a mixture of federal regulation and control was urged as a basic formula needed to ensure the airline industry's role in national transportation law, in a special report submitted to Congress by the WPA.

Prepared by the Department of Commerce, the survey, entitled "Federal Transportation Policy and Program," said the present national transportation network of airlines, railroads, highways and waterways is a "close grouping" of individual industries whose overlapping operations may fail to meet the country's transportation needs.

Chief of the national system is to be placed in a strategic position at the lowest possible cost to the nation and with as little federal aid as regulation is possible, the survey reported (see editorial) "centralized thinking" from Washington. Instead, the report favored more competitive pricing and servicing, with regulations imposed

only where there was a threat of monopoly or destructive competition.

The Committee of domestic airlines said it set a 10-year timetable for implementation of the suggested recommendations in order to give carriers sufficient time to change their services and to evaluate the effect of any recommendations implemented.

Specific recommendations made by the survey to improve the airline industry follow this general pattern:

- Government regulation should place the carrier in a position to compete fairly with air carrier with complete regulation of the airline by the Civil Aeronautics Board refused to allow greater freedom in establishing rates, subject to a minimum rate guarantee paid by the CAB. Board members should apply this power only in exceptional cases, the survey said, with maximum rates applied primarily to monopolistic practices.
- Lengthen and speed policies of CAB should be used to establish con-





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## IATA Carriers Set North Atlantic Fares

By Robert E. Farrell

Three-O'clocks of 51 international airlines, meeting here in emergency sessions to fix rates on flights on the North Atlantic and elsewhere last week, concluded their week of sharp debate with a hydrography of decisions out of which appeared a fairly strong world trend toward lower fares and, in expected separate fare structures, for jet and propeller aircraft (AWW May 14, p. 37).

Most of the new fare pattern on the North Atlantic will take as of May 1:

- Jet economy service from New York to London will be fixed at \$770 one way in place of the current \$257. However, the current economy fare carries a surcharge of \$15 bringing the actual fare up to \$272. This includes fare service in all but 52 of the current exchanges with the basic economy fare.
- Jet first class fare from New York to London will rise from \$440 to \$700 one way. Actually, this last figure is what most first class passengers currently pay twice on top of their first class ticket that are charged \$68 for de luxe service. Carriers have abandoned de luxe service but have incorporated the charge as a permanent part of the basic first class structure. After May 1, no jet surcharge will be levied.

While here North Atlantic jet fares were discussed IATA carriers impinged their on introducing new 17 day, cross time fares on both jet and propeller planes.

Between Oct. 1, 1960, and May 31, 1961, the carriers will allow a 17-day jet excursion fare of \$399 round trip between New York and London. Comparable propeller fare over the same route and during the same period will be \$130. Conversely, the lowest round trip fare between New York and London is \$463.

Most IATA carriers seemed agreed that separate fare structures should be offered between jet and propeller aircraft along the same routes. Thus, on the North Atlantic, the economy propeller fare between May 1 and Sept. 30 will be \$20 less than one way and \$36 less round trip. Between Oct. 1 and May 31, 1961 economy propeller fare will be \$30 less than jet economy fare one way and \$54 less round trip.

This distinction between jet and propeller economy class fares on the North Atlantic also was recognized for first class fares. First class fare one way between New York and London on propeller aircraft will remain at what currently is \$440. First class discounts on propeller aircraft will be \$100, the price of a normal jet first class seat.

Carriers also agreed that after July 1

only two services would be offered on the North Atlantic, first class and economy class. Until that time, however, the few carriers that still offer tourist service are continue to do so. In addition to the North Atlantic service, IATA carriers also hammered out the following decisions for other areas:

- **Mediterranean:** Present fare structure generally will be maintained until Oct. 1. After that date, first class fare will remain virtually unchanged but the fare service will be eliminated. Highest fare will be charged equal to jet first class and propeller first class with surcharge. As on the North Atlantic, annual first class propeller fare will be less than jet first class fare. Also after Oct. 1, designation of lowest mediterranean fare will be called "economy class." This fare will be about 16% lower than current tourist fare levels on the mediterranean. Meditarranean class of about \$30 will be maintained between propeller and jet flights in the mediterranean region. (Only, mediterranean carriers as of May 1 will offer special student fares.)

- **Europe:** In the same 15% lower than current mediterranean tourist fare.
- **Between Europe and Far East:** Also Oct. 1, first class fares will be increased slightly while tourist fares will be cut from 8-10%. Low fare service in this region will be called "economy class" and this fare, unlike the North and mediterranean regions, will be the same on jet and propeller aircraft. However, seating arrangements on the latter type aircraft will be more comfortable than on jets. Also between Europe and the Far East special excursion fares, carrying reductions of 22% over normal fares, will be offered as of May 1. Finally, it was agreed to maintain the present goal of first class on both jet and tourist class service within the Far East and Australasia.

- **Europe and Africa:** After Oct. 1, first class fares will be slightly higher while tourist fares will be cut some 10%.
- **Also, special excursion fares between the Union of South Africa and Europe** will be offered on a 90-day basis and at less than 16% below current tourist fare.

- **Transpacific:** Fares in this region remained the only failure of the emergency session. Reportedly, about as carriers concerned with this area could not agree on a first differential between jets and props. Another stumbling block over the issue of seating density on jet economy flights over the transpacific. Inadequacy of an economy fare on transpacific routes also was a driving point, though this issue was not voted on.

Nevertheless, since the carriers could

not agree on new transpacific fares, this region could be subject to an open rate situation May 31, when current fares expire. However, it generally was agreed between the carriers concerned that current fares be maintained at least until next fall. Final agreement on new transpacific fares probably will be reached at the next regular IATA meeting at Caracas, France, in September.

International fares elsewhere in the world, for example within Europe, the Middle East, South Atlantic and between the Americas had been settled at an earlier IATA conference at Helsinki (AWW Jan. 14, p. 40).

Besides decisions on fares, IATA carriers agreed that speech of jet aircraft made unnecessary the use of berths in aircraft accommodations. Carriers also agreed that propeller first class seats should be a more spacious than first class jet. Also carriers are to retain tourist seating density on their propeller aircraft even though the new fare will be called economy class.

An IATA spokesman explained that the carriers could not agree on a single title for low fare service which would apply to every international route. Therefore, carriers in certain areas in the Far East will be permitted to use the "tourist" designation for their low fare service, instead of "economy."

## British Adviser Favors Mach 2 Transport

London-Singapore transport design on should aim at long range and Mach 2 cruise speed, M. D. Morgan, scientific adviser to the British Ministry, told the Royal Aeronautical Society.

Morgan said that for medium ranges at about 1,500 mi. current advances in wing-jet aircraft design would allow Mach 1.2 speeds without large increases in operating costs, but that higher speeds are realistic with wing-jet aircraft.

At Mach 1.2, Morgan said, reasonable economies could be designed. Speeds between Mach 1.2 and 1.8 are unfeasible, he said, but the range between Mach 1.8 and Mach 3 is a realistic objective.

There is no strong case for long-range Mach 1.2 transports, according to Morgan, because transports in the Mach 1.8 to Mach 3 range would be produced with no more technical difficulty, and operating costs would not be appreciably higher.

A Mach 3 airplane, Morgan observed, was fast enough to reap the benefits of high speed on engine and aerodynamic

# AVRO748 AVRO748 AVRO748 AVRO748 AVRO748 AVRO748

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efficiency, but not so fast as to encounter kinetic heating problems. London-New York on route times at this speed would be reduced from seven hours to three hours and light aircraft would suffer about the same speed, and would be needed to meet the heating problems and would reduce only a further 45 min. off the Mach 2 aircraft performance.

Great steel was adopted, Morgan said, there would be every indication to approach Mach 3 in spite of the extra development costs and the greater air resistance in direct operating costs.

The Mach 2 to Mach 3 contract, he declared, would need good judgement—concerning air markets, timing and cost, and neither speed range type could be demanded.

In the Mach 3 category for advanced long, slender shapes with subsonic leading edges and supersonic trailing edges which would give sufficiently high lift/drag ratios and after aspect ratios high enough for a compressed thermal heating efficiency, approach speeds.

Between Mach 3 and 5 he suggested that the new aerodynamic theory of shock interference would emerge and offer higher aspect ratios. But previous studies had not proven particularly economic values for the configurations for such aircraft with swept propellers, he concluded.

## Canadair Is Offering New CL-44-D Models

Windsor—Canadair Ltd. has announced two new variants of the CL-44-D cargo transport including a model that will be powered by three IV Rolls-Royce Trent engines to give the aircraft a maximum gross weight of 125,000 lb.

Totalling below the Civil Aeronautics Board, Karl H. Larson, senior director of commercial sales, said the new variants, designated the CL-44-D1, will have a payload of 77,193 lb. with a fully loaded range of 3,120 mi. at a speed of 487 mph. The aircraft he said, could become available in August, 1967, and 30 could be completed by the following July.

Present version, the D1, which is now in production, has a maximum payload of 96,152 lb., cruise speed of 195 mph., with a range of 3,010 mi. See and version, the D2, is designed to carry a payload of 77,193 lb., but range is limited to 2,360 mi. It is designed for domestic operations.

Total of 17 of the D1 models will be delivered by July, 1967. An additional eight, however, can be completed by October, 1967, and another 12 can be delivered in the following February. If no more than 15 of the

D1s are required production of the D2 can be begun in time to bring the first of the second version off the assembly line by November, 1967.

Direct operating costs at the D1, D2 and D3, at maximum payload and stage, have been set at \$450.30, \$463.40 and \$497.95 per hr. respectively. Costs per mile are \$1.26, \$1.29 and \$1.32.

## Allegheny Management Shifted in Expansion

Washington—Allegheny Airlines Inc. announced the election of two vice presidents and a replacement of executive level duties to meet the company's planned expansion of service into New England and the integration of new flight equipment.

Nelson B. Fry, Jr., former vice president and sales for Northeast Airlines, has been named vice president sales and service for Allegheny effective this week.

Edwin L. Calabrey, who joined Allegheny in 1957 as assistant to President Leslie O. Barnes, was named to the position of vice president—passenger affairs and consumer affairs with responsibility for route and schedule planning and Civil Aeronautics Board matters.

A veteran of 25 years in the air transport industry, Fry also has served as a transportation consultant with the Atlantic Escape Commission and was employed by Capital Airlines before joining Northeast. In his new position, he will be responsible for activities relating to advertising, sales, visitor services, maintenance and in-flight services for Allegheny.

Under its schedule of expansion policies, Allegheny has goals. David L. Miller, present senior vice president and a director of the company's responsibility for public relations and state and federal affairs.

Walter J. Smart, vice president finance, also was elected chairman of the capitalization and growth committee in budget and cost control functions, while Vice President Richard G. Diamond will handle the airline's flight and operational programs along with its equipment planning, development.

Allegheny, formed in 1955 from six airlines, planned as a result of awards granted from a CAB decision in the Northeast Airlines Airline Case. It entered scheduled flights for Apr. 12 and June 1 will cover new routes linking Boston with Allegheny stops at Washington, Philadelphia and Pittsburgh. Commence 140-passenger aircraft will be used on the routes, which will include the buses of Providence, New Haven, Bridgeport, New London and Portland, on a schedule providing 22 new daily flights.

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Space Research in Life Sciences—Part 1:

## Report Cites Bioscience Needs

Focused among the questions to be answered is the exploration of space as these concerns life in the universe and man's ability to survive space travel. Space exploration programs, emphasis will shift from the remote perspective of the method of transportation to the knowledge of life in space and the ability to be present from these flights.

National Academies and Space Administration recently completed the assessing opportunities of a space exploration program, in meeting a fifth major domain in its headquarters. The Office of Life Sciences (NARS) (p. 127). The study that led to creation of the office is a clear expression of the need for a broader effort in the field, the resources now available and the great need to increase these resources on a national basis. American Space is publishing the report in two installments. The first presents a summary and a condensed version of the conclusions; the title of the life sciences in present status and the present status in that area. The second will present in detail the areas recommended by the report.

The objectives of space research in the life sciences are twofold: (1) investigate the effects of environmental conditions on living organisms; (2) understand the mechanisms of life (3) scientific and technological advances related to survival, flight and exploration in space.

The same issues which prompted the establishment of NASA and give it responsibility for all space research and development, have also prompted the establishment of the NARS, namely responsibility for biology, chemistry, and physics of the biological aspects of the natural space program.

Present and future needs were considered in three broad categories:

- Basic biological aspects of environmental environments with particular emphasis on those phenomena associated with weightlessness, radiation, isolation, and atmospheric pressure, and the effects of these phenomena on the development of complete organs in other organisms in planetary, atmospheric and space environments which may be pertinent to the evolution of extraterrestrial life.

- Applied to technology aspects of study and biology at this state in (current space flight, including effects of space environment on human performance, radiation hazards, tolerance of life forms and man's resources of life-supporting artificial environments.

- Method and behavioral scientific problems associated with space habitation in recognition of man's behavior, social behavior, and psychological aspects of the human condition in the space environment of life forms and man's performance in space exploration situations.

The Biological Advisory Committee issued the following recommendations:

- That NASA establish an Office of Life

Sciences having the responsibility and authority for planning, organizing and executing a life sciences program, including scientific and technical research, development and training.

- That a Director of Life Sciences be appointed who is directly responsible to the Administrator of NASA, in the same manner as at the new divisional level as the other program divisions.

- That the internal organization of the Office of Life Sciences include a committee for basic biology, applied medicine and biology, medicine and behavioral sciences, and the Life Sciences Educational Program.



Dr. Clark T. Ransil, director of National Aeronautics and Space Administration's new Office of Life Sciences, was selected for the post prior to establishing the governmental life sciences program. Initiatives and programs of the military services, industry and universities in cooperative activity of NASA's Biological Advisory Committee.

Former NASA administrator Dr. James D. Ransil is a member of the Armed Forces-National Research Council Committee on Biomedical and the Biomedical Research Group of the Defense Department's Research program. He also is NASA Science Representative to the Space Science Board of the National Academy of Sciences.

Dr. Ransil who earned his medical degree from Western Reserve University in 1945, was director of the Division of Neurology at the University Hospital of Cleveland from 1955 until he joined the NASA staff in July, 1959. He also has served as associate professor of New College at Western Reserve.

- That an internal life sciences program be fully established with three units:

- (A) Basic Biology

- (B) Applied Medicine and Biology

- (C) Medical and Behavioral Sciences

- That the Director of Life Sciences serve as the primary contact person for consultants outside of NASA to be appointed to the administration.

- That maximum integration of the personnel and facilities applicable to the space program life sciences in the military services and other government agencies be arranged in the most appropriate manner indicated by the nature of extent of the specific problem at hand.

- That the Office of Life Sciences accept major responsibility for education and training in the space-related life sciences through post graduate fellowships, training grants to universities and education visiting research opportunities to be arranged with other NASA staff in the area.

- That the NASA Life Sciences Program place special emphasis on the free exchange of scientific findings, information and criticism among all scientists.

- That society agencies be involved with great interest and limited to nature in clearly national security or clearly as well.

- That the NASA life sciences facilities be considered a public trust in implementing scientific and international cooperative efforts.

The Chairman of the United States has given to the National Academies and Space Administration the responsibility for the research and development of the life sciences. NASA has begun the fulfillment of the responsibility with its creation of the life sciences and with the establishment of a life sciences center which occupies a broader role in the system of their personnel to the degree knowledge of all subjects in the life sciences is a necessary condition. With this report of the life sciences will define the field in people have entered in other fields of the life sciences which is the engineering sciences, will in turn give a new life meaning to the national effort. The biological, medical and behavioral sciences are among these disciplines. The Research Advisory Committee has been appointed to act in supervising their strength within the NASA program.

The Russian task proposed the Congress to create NASA is a unique space program and to give it responsibility for achieving the potential of the national effort in space space study. It is the creation of NASA of a strong division of life sciences. As set forth below, two major units represent the role of the life sciences in the space program: space effort and should form the core of the proposed program in the life sciences of NASA. These are the health and behavioral sciences relating to extraterrestrial environments and the scientific and technological aspects of survival space flight.

## Environmental Life

Interplanetary Marine  
Flora and Fauna

Microbial Composition  
of Planets

Unknown Form of Life  
Extraterrestrial

Planetary Systems in the  
Universe

Terrestrial Life in Different  
Planetary Environments

Biological Cross Contamination

Chemical Contamination

## Problem Areas in the Life Sciences

Stress Factors

Compositional Differences  
Aerobic/Anaerobic

Weightlessness

Spin and Tumbling  
Vibrations/Static

None

Dark Periods and  
Light

Isolation, Confinement,  
and Flight

Dietary Mechanisms  
Time of System or  
Season

Methods of Escape and  
Communication

Evolution

Microorganisms

Visible

Unaware

Non-Linear

Course Keys

Nuclear Power and  
Propulsion Driven

Water Release

Waste Products

Toxicity

Microbial Flora

Therapeutic Stability

Energy Release

High-altitude-Supersonic  
Atmosphere

Therapeutic and Physical

Support for World Space  
Communication

Monitoring Warning and  
Safety Systems

and technology aspects of survival space flight.

It is a unique time that these nations, each of which is a major space power, have agreed to cooperate in their field of research and development in the life sciences. The life sciences are the most fundamental of all sciences, and the most important to the future of the human race. The life sciences are the most fundamental of all sciences, and the most important to the future of the human race.

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## Classroom Environment

Physics/Chemistry

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field of technology is rapidly becoming a high-tech, high-speed, high-precision activity. The design of modern weapons, military and aerospace, reflects the needs of the field and the need for the most advanced technology. The design of modern weapons, military and aerospace, reflects the needs of the field and the need for the most advanced technology. The design of modern weapons, military and aerospace, reflects the needs of the field and the need for the most advanced technology.

With the advent of space flight, the need for the most advanced technology is becoming more and more acute. The design of modern weapons, military and aerospace, reflects the needs of the field and the need for the most advanced technology. The design of modern weapons, military and aerospace, reflects the needs of the field and the need for the most advanced technology.

The present progress in this area appears to be centered in Project Mercury, the aim of which is to put a man safely into space for several orbital flights about the earth before return and recovery. There is need that this earthlike phase of space research and development be completed rapidly and that the design of modern weapons, military and aerospace, reflects the needs of the field and the need for the most advanced technology.

Problems inherent in manned space flight require not only special technical systems but also a special attitude and a special attitude. The design of modern weapons, military and aerospace, reflects the needs of the field and the need for the most advanced technology. The design of modern weapons, military and aerospace, reflects the needs of the field and the need for the most advanced technology.

space as great as the risks on a flight. Magnification of the effect of radiation is one of the most serious in flight conditions. The physical ground can only be reduced in a limited way. A number of measures are being taken to reduce the physical ground can only be reduced in a limited way. A number of measures are being taken to reduce the physical ground can only be reduced in a limited way.

These steps in space flight mean we should be able to put a man safely into space for several orbital flights about the earth before return and recovery. There is need that this earthlike phase of space research and development be completed rapidly and that the design of modern weapons, military and aerospace, reflects the needs of the field and the need for the most advanced technology.

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• **Toxicity and contamination.** Biologists and medical scientists are interested in our knowledge gained by in situ space, in the form of stress and neurophysiology as indicators of stress under in situ or within exposure occur in the form of chemical compounds, which might gradually build up in one atmosphere to the extent that they become health hazards. The problems of toxicity and stress concerning rocket fuels are, examples of such toxic, materials. NASA should maintain a research staff to deal with such health hazards and future engineering planning should be aimed to control stress and remove limitations for public health protection.

In closed space vehicles, atmospheric contaminants, including of biological organisms, may affect those concentrations and signs, special attention.

Science is an ancient, practical problem and in these examples above, depend upon a broad base of information obtained in space, fundamental aspects of medicine and biological sciences. Although much of that information is being accumulated in the course of the extensive research in this field, it is necessary and critical to the future of space science are especially dependent upon a number of specific areas, examples of which can be outlined below.

• **Regulating physiology—**including the control mechanisms and physical phenomena of circulatory responses, gastric delivery and exchange, effects of vibration in an actual condition of stress, and hyperthermia.

• **Cardiovascular physiology—**including circulatory response, the control of the circulatory system in response to gravitational and accelerated stress, its interaction in oxygen and carbon dioxide balance and temperature change.

• **Neurobiology—**including circulatory, sensory, and performance under stress conditions, adaptation, and response to hypoxia, hypoxia, and response to hypoxia.

• **Neurophysiology—**including control and regulation of the physiology of stress and hyperthermia, and adaptation to stress conditions, and adaptation to stress conditions, and adaptation to stress conditions.

• **Behavioral science—**including perception, motivation, and performance under stress conditions, adaptation, and response to hypoxia, hypoxia, and response to hypoxia.

Space Research in Life Sciences—Part II—will appear in our next issue.

AVIATION WEEK, March 21, 1960

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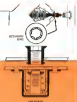
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## MISSILE ENGINEERING

### Thiokol Tests Advanced Solid Polymer

By Michael Yaffee

Troy, N. Y.—Chemical Division of Thiokol Chemical Corp. has developed a new rocket fuel that is expected to find use in significant volumes of casting solid propellant made extreme such as the Space Shuttle.

The fuel could also be chosen for space rockets such as Nike Zeus and Pegasus, in which choice of fuel propellant has not yet been made. Another important possibility and one the company would not discount on is whether the new fuel which is said to be ideally suited for very large rocket engines, would be used by Thiokol in a bid for the prime position as the second stage powerplant of the Minuteman ICBM, on which Thiokol is now backup to Aerojet.

Involving a very advanced chemical modification of Thiokol's original polybutadiene rubber fuel binder, the new fuel polymer—called only C-12 for the present—is said to combine the high oxygen content of the new hydrocarbon solid fuels with the outstanding physical and processing properties of the older polybutadiene fuels without compromising either.

#### Hydrocarbon Fuel

Processing is the new fuel is, however, Thiokol doesn't consider it the end of the line in conventional composite solid propellants. The company is closely carrying out research aimed at improving the new polybutadiene fuel further. For now, significant the company is believed to have developed a new hydrocarbon fuel much better than its present PBAA (polybutadiene acrylate) hydrocarbon propellant, but Thiokol declines to discuss any of its hydrocarbon fuel work.

In light of these and other solid propellant developments, testing will undoubtedly prove an important factor in the future of the new C-12 polybutadiene fuel. At the present time, the fuel is estimated to be in months away from pilot plant (10,000 to 50,000 lb/month) production. It has already been tested in small scale rocket motors. The next step will be full scale motor firing to establish actual specific impulse figures along with other factors.

This step will be the critical one. If Thiokol can get approval to carry out these tests, using other's hardware, on one the Minuteman, then the new propellant may gain an important boost along the way. Otherwise the company will prob-

ably carry out the firing with its own test cells, Falcon engines (which contain about 75 lb. of propellant).

In time, the company will be able to qualify its propellant even for large rocket engines, but will probably have to start from scratch in a bid to get it into a new missile system such as the Minuteman. Once a missile engine has been selected, the company will have to get it into a new missile system such as the Minuteman. Once a missile engine has been selected, the company will have to get it into a new missile system such as the Minuteman.

One of the basic advantages of Thiokol's new polybutadiene fuel is its im-

proved performance in increased in specific impulse. Unless it is used in a solid propellant, the company's gain in specific impulse offered by this fuel is a matter of only five seconds or so. But this fuel is not at hand and with the military looking for even additional pounds of payload in order of range problems in rockets, solid propellant competition are selling even added seconds of impulse than can get in a bid for new contracts.

At the present time, there are three principal types of composite solid propellants in use. They all use the same



**FACT PLANT** at Thiokol's Troy, N. Y. plant will be used to produce up to 50,000 lb/month of company's new solid rocket fuel. In center the fuel storage chamber will combine solid polybutadiene with an organic diisolate to make the new polybutadiene polybutadiene polymer.

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**HAIRY STIPS** in testing the specific impact of organo polysulfide on the properties of PS, it shows above: (2) increasing the number of higher contribution energy C-Si units in the hairy polysulfide structure; (3) isolating the low energy formal linkage to the amorphous more energetic rigid (1,3) linkage which contained only one 'spiral' oxygen atom instead of two; and (4) eliminating the oxygen linkage altogether and thereby increasing the number of C-Si units between the end sulfur atom that mark the end of the hairy polysulfide molecule and this structure is one of two that are actually obtained.

radical anionic polymerization, but differ in the polymer that is used as the fuel. Somewhat loosely as far as strict chemical terminology is concerned, this is termed based on the selected fuel hydrocarbon populating polyalkyl, propylene, and polyethylene, monomers.

Originally, the hydrazination propellant held a double edge on the polysulfide propellant in terms of cost—in some cases, as much as 10¢ per lb. specific impulse. But polysulfide polymers, marketed to start in the rocket propellant primer business, among other reasons, that offered better low-temperature properties (a propellant that won't freeze is more important than one with high impulse in a severely that area).

operates at low temperatures), ease of processing, low shrinkage (in some cases, propellants go off so far away from the casing when used that the propellant has to be filled with a propellant pellet) which are not lost in the evaporation, gained in the processing and one of this type of propellant which is the subject of the third.

With the recent addition of rural residents to stable, combination and income taxes, as well as paraprofessionals, the picture changed. Rural addresses approximately equalled the wrong, control of all compounds, populations growing there a defined specific targets, around 145 are

Hydrocarbon's usage also on the



## Molybdenum Nozzle Machined for Polaris Rocket

Multi-directional socket attitude lines for Polaris sled propeller first stage we have numbered as a production line of Gostov Tool & Manufacturing Co., Minneapolis, Minn. Accurate contour machining of forged pure nickel alloys was considered important and a few months ago the company sent the made lines are maintained and hand with suitable tools under regular control. Wall thickness of the bar is held to  $\pm 0.031$  in with a maximum total tolerance of  $\pm 0.001$  in required on two tooling pieces through the center of the throat.

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## AVIONICS

### High-Density Avionic Units Developed

By Barry Miller

Pn-T, the technique for high density packaging of micro components into functional modules suitable for design into airborne digital computers, has been developed here at the Research Center of the Birmingham Corp.

Referred to as the Macro Module approach, the technique combines the basic Birmingham plug-in lead and high density packaging. This involves leading at the circuit system function, at various interconnections and ways of mounting heat, rather than focusing all attention on individual microelement power assemblies. The idea of microelement components can easily be lost, Birmingham believes, by ignoring the complex problem of circuit interconnections.

The firm expects to incorporate its Macro Module technique into a digital differential analyzer by the end of the year, according to a Birmingham spokesman. Another system now under development here also employs the technique.

Principal features of the packaging technique, and its end products, individual functional modules, or Macro Modules, according to Stanley Schneider, a development engineer who headed up the development, are:

- Incorporation of a heat exchanger as an integral part of each module to provide efficient conductive transfer of heat from the source to a sink.
- Symmetrical circuitry in two dimensions with the third dimension a variable determined by the needs of the system into which the module is designed.
- Use of available components in present design and allowance for growth with deposited or etched components or circuits as they become available.

#### Printed Boards

Each Macro Module is built around small, solid chips which contain printed circuit boards on which are soldered the components for individual circuits, such as logic elements. Large numbers of chips are plugged into a back plane circuit board which interconnects the chips. Fine seek circuit boards are hinged together along their lengths so that they can be wrapped around a heat exchanger with every chip interlinked with a fin of the exchanger to provide a maximum amount of heat exchange. Every module thus can contribute a specific substance

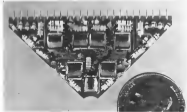
which, combined with others, forms a complete system package.

Birmingham built a mockup of an airborne digital computer to study the feasibility of its Macro Module approach. Four individual modules were designed into a single package with face dimensions of 4.75 x 4.75 in. and with a height of 7 in., at total volume of 0.002 cu ft.

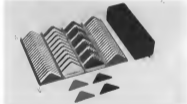
Every module in the model contains 176 chips, each soldered for functional identification, along with the necessary input connection and inter-

connect connections. The number of components per chip varies between 12 and 38, depending on the circuit function of the chip. In all, there are 36,700 components in the four modules and by extrapolating this number for a volume of one cubic foot, Schneider figures an operative system would have a Macro Module component density of 360,000 components per cubic foot contained in 7,000 chips, along with connection and connect interconnections.

Basic to the scheme is a triangular chip, one inch in height and 1.75 in.



TRIANGULAR circuit board with 41 standard components mounted as shown can be soldered within a plastic shell to form one chip of a Macro Module. Quarter circle on it is not from the type of the triangle so that four chips can fit snugly about conductive heat cone of heat exchanger.



MACRO MODULE has a large heat exchanger which is built a receptacle for, and an interconnection between, the chips, two of which are removed and displayed to the foreground. Heat exchanger is at right of partially filled heat plate. Color of chip identifies its circuit function.

along its base with a thickness of 0.016

The long dimension of the chip is fitted with an input-output connector. Components are assembled on a double-sided printed circuit board and then encapsulated within a thermocuring plastic casing, called a shell.

Every chip can be designed to per-

form a specific function. One module of the Bernagoli logic computer, a 7000i software unit, contains five different types of chips. The components count per chip range from 32 for a set of eight double "and" gates to 50 for a combination package of inverters, amplifiers and "and" gates, Schneider says.

The actual number of components contained in a chip is fixed by the number of chip connection pins which, for this study, was set at 24. The number of chips in a module varies, depending on the function of the module.

Standard components, such as diodes, isolators, metal film resistors and capacitors, have been used in the Micro Modules developed in the Bernagoli laboratory. As time progresses, deposited film components could be used within the framework of this modular approach. This also might lead to a reduction in the thickness of the chip.

#### Assembly Stage

To reduce the number of connections between components, Bernagoli requires packers to obtain components without leads from the manufacturer so they can connect the components in the assembly stage. As the interconnection among components are cut down, recent technology should be benefited.

Because the entire chip is encapsulated, encapsulated components which are smaller without coatings are preferred for the chip. In the case of transistors, however, Bernagoli experimented with encapsulated units only to find they didn't work out well and has abandoned these experiments at least temporarily in favor of encapsulated units.

This modular technique also tends to force the manufacturer to make chips in module plug-in and out of the back plane and with color identification. Both units can be replaced without too much trouble by similarly-colored chips. Faulty chips can be discarded, or they work better in a serving center for individual circuit troubleshooting.

Besides serving as the female connector for the chips, the back plane provides the structure for the module. Its four boards are hinged to permit folding about the heat exchanger.

#### Board Width

Width of the board is determined by the base length of the chip while the length of the board is a function of the number of chips used in other words, the specific selection function.

Circuit interconnections are made on the back of the printed boards by two layers of printed circuitry directly bonded to the board, minimum cable harness and flexible wires between adjacent boards.

For heat removal, Bernagoli engineers have designed the chip to provide large surface shell areas which are in contact with a metal fin of the heat exchanger. A center core tube supports the fin and can be used as a number of forms of heat exchange. The heat exchanger could be part of a heat pump system which would provide the modules with temperature control. It

is leaving air, temperature, temperature, it will be possible to use automatic for components which have wide variations in value with temperature.

The tube of the exchange receives a volume of air which is acting quarter inch in the apex of each chip so that when the back plane is folded over the face area of chips fit carefully about the tube.

With this modular arrangement, the added space required by exchanger has integrated between chips is shared with space required for interconnections on the back plane board.

The Micro Module technique, Bernagoli says, permits packaging standard components into modules, the volume produced occupied by airborne computers with an older Lap-Med technique. As miniature components become available, and are used in the design of airborne computers replacing the design approach, the total volume reduction will be one fifth, he says, the firm says.

### Expansions, Changes In Avionics Industry

Antenna Systems, Inc., Hingham, Mass., is a new company formed by several former employees of D. S. Kennedy & Co. The new firm, headed by Charles W. Gosses, Jr., president and Walter W. VanderWalt, Jr., executive vice president, will design, manufacture and install antenna systems for communications, radar, air defense and missile space radar systems and guidance. Address is 516 Lincoln St.

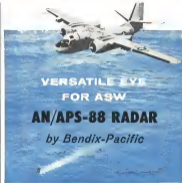
Other recently announced changes and expansion among aviation firms include the following:

- **Electronic Engineering Co.** of California has purchased **Avionics Electronics Co.**, Anaheim, Calif., which produces a pinhead paper tape reader. New acquisition will operate as a subsidiary, with Robert T. Arnold, former president, as division manager.

- **Leach Corp.**, Compton, Calif., has acquired **Electronics Laboratories, Inc.**, producer of subminiature solid state component series for avionics and space vehicles. Edward M. Hendrickson, vice president of the new acquisition, will act as manager of new Leach division.

- **Wyle Laboratories**, El Segundo, Calif., has acquired **Parascan, Inc.**, a testing laboratory in New York Park, N. Y., which will become **Wyle-Parascan, Inc.**, and continue operations at present location. Frank S. Wyle, president, says the company plans to expand the research facilities and add engineering activities.

- **Link Division of General Precision, Inc.**, has opened a new research and



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Development Laboratory in Washington, D. C., area, at 9217 51st St. in College Park, Md. The new laboratory, to be headed by Owen E. Cunningham, will develop electromechanical and electronic equipment for missiles, range instrumentation and ground support.

• **Sunbeam Corp.**, Chicago, acquisition of John Oter's Mfg. Co., Racine, Wis., as a wholly-owned subsidiary will be subject to stockholder approval next month. Acquisition will put Sunbeam entry into automatic field with John Oter's *American Division* sales estimated to exceed \$21.5 million this year.

• **Telesupergraph Corp.**, Los Angeles, has acquired the assets of Phoenix Engineering and Mfg. Co., Phoenix, Ariz., maker of aviation parts, which will be operated as a subsidiary under Harold C. Olson who founded the company in 1959.

• **ErnstMcCollough**, San Carlos, Calif., has acquired **National Electronics Inc.** and **Industrial Tapes, Inc.**, of Geneva, Ill., both of which will be operated as wholly owned subsidiaries. The new acquisition, which develop and produce thermocouples, sensors and industrial tapes, have annual sales of about \$5 million.

• **International Telephone & Telegraph Corp.** has opened a new advanced development laboratory at San Fernando, Calif., to carry on research and development of special microwave tubes. The laboratory is directed by Christian G. Langer.

• **Litton Industries** has acquired Electronic Systems Division of General Controls Co. The acquisition products are data computers, navigators and flight control instruments. Fred Marsh has been named as manager.

## FAA Tests Pictorial Navigation Displays

Flight tests of manual navigation displays operating from VOR/DME information resulted in a 30% reduction in communication workload between controller and pilot, according to Federal Aviation Agency, which conducted preliminary tests at its Atlantic City facility.

The tests, consisting of 230 flights and 240 simulated flights, involved two different general drivers, both relying solely on VDU/DME information. The FAA pattern display employs a spot of light on a map to indicate position followed by an arrow of light indicating ground track. A pictorial navigation display, developed by the Avion Division or ACF Industries, affords a moving vehicle, or "bug," on the display map which follows the ground ground track.

Accuracy of the pictorial display distances was determined by radar monitoring of the test flights with sensors fitted

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with a plastic overlay upon which the pictorial display track was depicted. A ground plotting instrument and console in the cockpit and at the radar scope provided simultaneous recordings of the aircraft track and that of the surface in the display device.

FAR also that the recordings indicate that pilots using the personal display devices were able to adhere to dog-fight maneuver with accuracy satisfactory for traffic control purposes.

### 1973 FILTER CENTER 1973

► **NBC Issues Call for Action—**Proactive authors who want to deliver a technical paper at the National Electronics Conference, to be held Oct. 10-12 in Chicago, should submit 100-150 word abstracts and a 500 word summary as the complete paper for review by May 1. Papers and abstracts should be mailed to Prof. Thomas J. Jones Jr., School of Electrical Engineering, Purdue University, Lafayette.

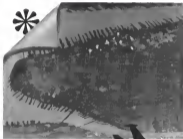
► **Space Navigation Conference Planned—**Conference on space navigation will be held Oct. 19-21 at the Dolphin Hotel and Civic Center in Columbus, Ohio, sponsored by the Institute of Radio Engineers' Professional Group on Space Electronics and Telecommunications.

► **Non-gas Reference Treated—**Flight tests of a low-cost (S100), non-gas reference in a tactical type missile have encouraged its development, the Martin Co., Orlando, Fla., to propose its use in Minuteman systems. Scramble with only 1 deg./sec. limit reference application in short flight time missiles such as Bullpup or Lacrosse. Company is presently studying its ability to manufacture the reference.

► **Isolated Master in Steps—**A 600 line Master will soon be assembled at the Martin Co. as Orlando is the first step in development of a series of devices expected to lead to a solid state infrared Master. Company's goal is a highly sensitive amplifier and modulator for long-range space communications.

► **SAGE Radar—**An AN/FPS-35 radar expanded for the SAGE system is near completion at Montreal, N.Y. The radar is one in a series of 12 being built for the Air Force in Space Cooperative.

► **Radar Range Boosted—**Improved accuracy of ground based radar, equal to 75% range as 125% area coverage is count, has been achieved with General Corp. Texas parametric amplifier (AW Sept. 1, 1971, p. 64) using treble-bass pumping. Tests were run on E-band radar at Rome Air Development Center.



### \* What's Behind This?

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## NEW AVIONIC PRODUCTS

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• **Direct-current amplifier.** Type DCA-1B, is made of solid state components assembled in a form suitable for plug-in operation. Frequency response is about -3 db at 200 kc, gain constant is



$\pm 0.01\%$ . Inputs and outputs are  $\pm 0.25$  v and drift is 80 mV/sec, referred to input. Dimensions are  $4\frac{1}{2} \times 14\frac{1}{2} \times 4\frac{1}{2}$  in. Pictorial Electronics Corp., 1915 Avenue A, Los Angeles 25, Calif.

• **Mini, pre-amp assembly.** Type MMX-5 covers 0.5 to 9.6 kHz range and provides 10 output bandwidths of



100 mc. MMX-5 has 17 center frequency of 250 mc, gain of 15 db, and overall noise figure of 10 db. LEL, Inc., 350 Oak St., Cambridge, 1, N. Y.

• **Variable divider.** Models MA-4255X through 4257X, for use in parametric amplifiers, harmonic generation and other noise oscillators are available. Overall dimensions of these oscillators are 1 in. diam. length x 1 in. max. diameter, package thermal capacitance is approximately 0.2 per second and load inductance is about a nanohenry. Type MA-4255X has max. harmonic stage from 0.4 to 1.4 per second and a cutoff frequency of 60 to 80 mc. MA-4256X and MA-4257X have 1.2 to 2.5 and 2.5 to 4 per second

and low impedance, respectively, with constant cutoff frequencies of 30 and 50 kHz, respectively. Microwave Associates, Inc., Burlington, Mass.



• **Trimming potentiometers.** Series 375, have low watt power rating 10 to 50 kilohms resistance, weigh less than a gram and measure  $0.175 \times 0.175 \times 0.175$  in. while larger composition potentiometers, series 500, are rated at 2 watts, provide 10 to 100 kilohms resistance, weigh less than 2 grams and measure  $0.5 \times 0.5 \times 0.175$  in. Pots have superior performance, solvent stable, dual contact wipers and are sealed for reliability against environmental exposure, according to manufacturer, Bantrol Corp., 11567 Tennyson Ave., Los Angeles 64, Calif.

• **Control finalizers.** Series RDL-3, have low watt one band stable frequency range, with one model, RDL-3N, covering from 500 to 4 kHz with a ratio of 105 or less. Available from stock in standard connection, these models incorporate sealed contacts on ceramic base and can be used with up to 2 watts. Radar Design Corp., 1004 Polaris Drive, Syracuse 11, N. Y.

• **Function potentiometers.** Model 78, available in resistance values up to 75 kilohms with  $\pm 5\%$  tolerance on stand and pin or remote 1% on special units. These potentiometers will handle up to 2.5 watts, have less than 0.5 mV/cm. leakage per section and will operate between -55°C to 150°C. New England Instrument Co., 1134 Main St., Waltham, Mass.

•  **Sweep oscillators.** Models TO-1 and TO-2, consisting of variable inductor and intensive oscillator will deliver 2.5 volts  $\pm 10\%$  ratio 500 ohms with 12 to 24 v input. Output frequency ranges



are 50 to 5000 kc. for TO-1 and 500 to 1,600 kc. for TO-2. Current requires up to 15 ma. across 150 ohms, 3 levers. For full output range. VARID, Co., Inc., 235 Commerce Ave., Stamford, Conn.

### Test Instruments

• **Digital frequency meter.** Model 7175, measures frequency from 10 cps to 110 mc with accuracy of  $0.0001\% \pm 0.1$  cps. Sensitivity is 100 mV, input impedance is 1 megohm up to 10 mc and 100 ohms above 10 mc. Meter occupies 8 1/2 in. full rack space. Beckman Instruments, Inc., 1280 Wright Ave., Richmond, Calif.

• **Digital data display.** Model S 55B, provides 6 cm. x 10 cm. raster projection of digital data on a 5 in. flat face cathode ray tube screen. Interval



horizontal sweep, available from 5 to 50,000 cps. Unit weighs 80 lb. Watman Products Co., Inc., 2415 Emerald St., Philadelphia 25, Pa.

• **Real frequency video generator.** Type 1100 A, provides constant or square wave outputs from 10 cps to 20 kc, sinusoidal outputs from 20 kc to 12



mc, and square wave outputs from 20 kc to 2 mc. for video signal and video sweep.

Output levels are at 10 volts. Price is \$3,550 f.b.w. West Coast, Most General Radio Co.

• **Memory tester.** Type 1613, a complete system for testing coincident current core memories under simulated computer conditions will test planes in arrays up to 64 by 64 with several patterns of information in single operation. Other models are adapted for testing laser selection matrices and for checking several digits in coincident current memories simultaneously, according to the firm, Digital Equipment Corp., Needham, Mass.

• **Digital deviation voltmeter.** Model D50130, measures resistance and provides results in percentage of deviation from a nominal value. Meter reads  $\pm 5\%$  of total resistance to absolute ac-



curacy of 0.01%. Selected 5% range is measured in three-digit accuracy. Average balance time is one second. Electro Instruments, Inc., 3550 Avila Court, San Diego 12, Calif.

### Power Supply

• **Power supply.** Completely insulated and designed for computers, cuts off all outputs when one single output is excessive. One available outputs are 15 v at 10 amp.  $\pm 6\%$  at 15 amp



and 45 volts at 1 amp. Load and load regulation are 0.5% and ripple is less than 5 mV. Overall dimensions are 7 1/2 x 17 x 17 in. Avair Electronics Corp., 775 West Washington Blvd., Pasadena.

• **Power supply.** Model 325, is transformerless, provides 110 to 24 v d.c. adjustable with regulation, no load to full load of 250 ma., of 0.5%. Unit operates from 115 v, 60 cps, and measures 4 1/2 x 4 1/2 x 5 in. Minimum load, to peak ripple is 0.005 v. Transistor type rectifier, Inc., Townsend Drive, Flushing, N. Y.

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# AERONAUTICAL ENGINEERING



EAST GERMANY'S fast two production Type 152 transport aircraft are on final assembly line at VEB Flugzeugwerke, Dresden.

## East Germans Push Type 152 Production

By David A. Anderton



ONE-TENTH MODEL of Type 152 (below) shows interior. First O14 A-0 (below) is first production model. Production 152s will have O14 A-1 turboprops (2,260 hp thrust)



Before—Push start has been made in both production and exportation drives for East Germany's Type 152 transport aircraft.

The fast production hatch is nearing completion on the line of the VEB Flugzeugwerke at Dresden. Probably about 12 airplanes are in various stages of completion, and one overseas order and first flight of the first production airplane was scheduled for early this spring.

Sales representatives for Technoexport GmbH of Berlin have just completed a sales tour through South America where they talked to airlines about the prospects of Type 152 packages.

There have been program delays, caused primarily by the loss of the first prototype about one year ago. The re-engineering, redesigning and additional test work that followed delayed the production program, which at that time was just getting underway.

Latest official statement of program status and goals came during the technical fair here, when Heinrich Rau, Minister for Foreign and Inter-German Trade of East Germany, said that the Type 152 would be available for export by the middle of 1981 at a price comparable to that of the Sud Caravelle.

The only question now remaining in the minds of many observers is whether

or not the builders will make the date.

The Type 152 transport is an unconventional conventional four jet swept wing aircraft with some design details that give it an unconventional structural or mechanical appearance.

Built around the Ilyushin 15-60 wing, the Type 152 is available in three basic versions: 28-seat four class 28-seat normal category, and 75-seat economy class (AW Dec 14, p. 134). In the latter layout it is most closely comparable to the Caravelle now in service with several airlines.

Maximum range, with 40-pass fuel reserve, is on the order of 1,000 stat mi. putting the airplane into the short to medium-range category of transports. It is designed to operate out of fields down to ICAO Category D.

All weather instrumentation, modern communications equipment and navigation aids are included in the Type 152, and there is provision for the installation of satellite radio if desired.

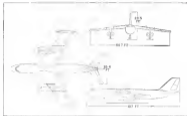
Cruise speed is just under 500 mph, or 4,000 ft on the order of 15,000 ft. Takeoff distance over a 15 ft obstacle is 8,000 ft. Pattern and approach speeds are low, and landing speed is 127 mph.

### All-German Design

The Type 152 transport is the product of an all-German design team headed by Paul Bonczak-Berndt. Work on the project now is under direction of Fritz Fritzsche, a structural and materials specialist. Bonczak has been named to a position as research director for the aircraft group, and more observations before he was "letted" upon after the accident to the first prototype.

However, it would be logical to have the work under Fritzsche, since the plane is out of the development phase and into production. Bonczak now will be working on other designs, particularly the Type 155 twin jet 34-passenger II-14 replacement.

The Type 152 is not a pretty air-



TYPE 152 has a 35 deg. swept wing. Pushed turboprops are close to ground for accessibility.

plane, and has a rather chunky and ungainly look. But it has a solid, functional look that seems to belong to a country where buildings or trucks or airplanes have long been designed for work and not for looks.

In size, weight and performance the Type 152 compares with the Caravelle Mk. II, which also is a 1980 airplane (see box). While loading of the Caravelle is a little better, and the thrust loading is a little less than those of the Type 152, total weight and performance are about the same.

The major difference is that the Caravelle has a lower percentage of structural weight than the Type 152, and can therefore carry more fuel for increased range. Type 152 shows considerable differences in the wing-panel curves compared with the Caravelle.

Principal of the Type 152 transport is a quartette of Pratt O14 A-1 turboprop engines designed and developed by the VEB Industriewerk Leitzschewitz. The engines are mounted in pairs in underwing pods. Fitted installation drops the engines close to the ground so that maintenance is easier. A small fuselage curve with a down bend at the end of the wing is used to dismount the engine when necessary. The curve attaches to two strong points on the nacelle pylon on either side depending on the engine to be moved, and on wing the engine



DOUBLING STRUCTURE inside area of window framing left of Type 152 has been to double wing. Forward pressure bulkhead (right) for Type 152 shows the built-up design of the component. Scarf is comparable to Sud Caravelle Mk. II in size, weight and performance. Caravelle has a lower percentage of structural weight than 152 and can therefore carry more fuel.



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### **Type 152 Performance**

Maximum speed (15,480 ft.) 871 mph  
 Cruise speed, mph 897  
 Landing speed, (79,160 ft.) 127 mph  
 Cruise altitude 30,000-35,000 ft.  
 Takeoff distance, (325,500 ft) takeoff weight and  $V = 1.13 V$  4,500 ft.  
 Takeoff distance, (at 305,500 ft) takeoff weight and engine out and clearing 75 ft obstacle 4,800 ft.  
 Landing distance, (at 79,160 ft) clearing 50 ft obstacle 4,700 ft.  
 Landing roll (at 79,338 ft after touchdown) 2,140 ft.  
 Climb performance at 105,000 ft Sea level rate of climb, ft/sec 6,334 ft/sec  
 Climb speed for best rate 351 to 410 mph.  
 Time to come altitude about 19.5 min Sea level rate of climb (one engine out, flaps and gear down) 593 ft/sec

out of the turbine, load it on a slatted duct, and heat the new engine into place. The same can be carried on board as part of the engine's load kit.

Portthrust operation of the engine is expected to take between 5 and 5 min. T.O. 50-lb. engines can be performed in 1 or 2 ft. according to company figures. This base includes clearing of fuel and oil filters and an overall visual inspection of the powerplant.

There is a bid from all four engine manufacturers to drive the wing and tail landing edges and the air intakes. Each engine also drives a hydraulic pump which supplies the fluid under pressure to the various components of the hydraulic system.

Each engine and turbine is protected by a super fire-extinguishing system. Detectors are located in the turbine, on the hot end of the engine, in the joints, the leading edge of the wing and in the flaps in the area of the engine. This system is fire warning to both pilots and the flight engineer, two bottles of extinguishing fluid injects through detector switches opened in flight engines.

### **Fuel System**

Total annual fuel capacity of the Type 152 is 4,170 gal. stored in 56 rubber tanks—eight in a wing panel and in the two streamlined containers at the wingtip. As additional tanks can be installed in the wing panels and inboard of the engine mounts by give a maximum fuel capacity of 5,010 gal.

Refueling points are on the upper wing surface at the fuselage cut-through structure, and the fuel system can be filled from the ground simultaneously. Landing time is about 20 min. maximum.

Fuel can be dumped as an emergency in 4 min. through nozzles at the tail

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ing edge of the wing's container.

The plane has a dual hydraulic system subdivided into a main and an emergency system. Main system power comes, at low engine-draw fuel pressure, which feed the accumulator which in turn feed four high-pressure pumps. Main system pressure is 3,100 psi.

**Emergency System**

The emergency system is operated off two electrically driven pumps, which charge the accumulator in store. If the accumulator is empty, all hydraulic fluid, a transfer valve switches fuel into the system for emergency operation of the hydraulically driven components.

Main hydraulic system retracts and extends the landing gear and wing flap, stores the nosewheel operation, the main fuel boost, opens and locks the hatch for the crew compartment, dumps the fuel and operates the control without power boost assist.

The emergency system can be used to dump fuel, extend flaps and gear, steer the rudder, apply the main gear brakes, and open and close the hatch for the crew compartment and the main passenger cabin door.

The plane is protected and air-cooled by the main power air blower driven by the engine compressor. All pressure action of the fuselage includes a freight section aft of the passenger cabin.

**Cabin Altitude**

Cabin altitude is held at about 6,100 ft at cruise altitudes up to about 35,000 ft. Emergency oxygen system supplies each passenger seat, masks are individual and are in a oxygen-tight compartment built into the back of each passenger seat. There, also, is a full-time oxygen system for the first pilot's position.

Heater, cooler and air source of the Type 152 equipment are integrated to eliminate additional heating elements caused by electric dehumidifier of the cabin at high speed cruise level. Airman and elevator each have three separate, and the rocket has two.

Aircraft and rocket are power-booster hydraulically. Control forces are fed through either the boost system or the normal actuator to a servo link which also deactivates a trim tab. Single-dotted landing gear, are divided into three segments also, each separately actuated by the hydraulic system. A three-way autopilot is installed.

**Access Device**

Access to the cockpit of the mockup was through AMERICAN WEST, so only company stations are available to access the front, which is apparently over-engineered and in keeping with current design. Normal crew is four to



Mars

Tomatoe (in red) look glow more more suggested blood and redness to the ancient, Mars was named for the God of War. Of all the planets it is the only one we can readily observe. Mercury is too near the sun and heavy clouds veil the surfaces of the rest.

About seven every two years you may see a bright star rising in the heavens as the sun sets. The scientists named Mars for the God of War, perhaps because in them its redly color suggested blood.

Of all the planets, we know Mars best. We see it most clearly. We study it most closely. Yet, Mars has always been a mystery to men. And so it is today.

Of course, we know something

**Changing Concepts of the Cosmos**

Representation of one of the finest, current drawings of Mars, showing the visible markings of the planet, and a yellow dust storm sweeping across its surface. The original is by Dr. G. Neumann of Harvard College Observatory.



about Mars. It rotates on its axis with a day of 24 hours, 37 minutes. It has changing seasons, and a diameter about half that of the earth.

Through a large telescope Mars looks reddish-pinkish with patches of grey or gray-green. What are these patches? Ocean, said early astronomers. Vegetation, we believe today.

We can see the polar caps of Mars most clearly than layers of frozen water, for they vanish in summer and return in winter.

On Mars, you would feel the atmosphere thin and probably composed of carbon dioxide and water vapor. There would be very little water. The Martian sky would be smoky black, and dotted with high-

floating blue or violet clouds of fine snow.

You would face storms at times. And strong winds that sweep up large clouds of yellow dust as they drift across the planet.

Some observers have said they see a complex web of line lines on Mars. Others, equally reliable observers have seen nothing. Most astronomers now agree that these controversial "canals" may be only an optical illusion. But they are surely not artificial interferences.

There vegetation exists—and we believe it does on Mars—would life be possible, too, though it is not likely that human-like life will be found. But here we have no reference close.

valians. Only exploration of the planet—first by probes and then by manned expeditions—can answer this question in a final way.

Because we believe that extraterrestrial life is possible, we must play a vital role in the future. McDonnell Aircraft has instituted important basic research in astronomy, radioastronomy, planetary, chemical, kinetic and meteorology.

These research programs are organized around a better understanding of the universe. That means men of all nations—may cooperate in the exploration of space, the moon, the sun, and the planets. That, though such adventures, may may better understand themselves and our planet.

**McDONNELL Aircraft** St. Louis 65, Missouri







ALL-METAL Beech Debonair sports low, straight Continental IO-470-J fuel injection engine it rated at 127 hp at 2,600 rpm.

## Aviation Week Pilot Report:

# Rugged Debonair Is Stable, Responsive

ENGINE is cooled by air entering nose cowl; passing out through lower cowl.

By Robert I. Strakoff



Teterboro, N. J.—Beech Aircraft's new four-place, single engine Model 33 Debonair is a nondescript, rugged airplane located at full gross weight—2,900 lb.—in the utility category. It is stable and responsive both at low speeds and at fairly rough air, a flight evaluation by its wings. It was said.

The all-metal Debonair is powered by a six-cylinder Continental IO-470-J fuel injection engine rated at 125 hp at 2,600 rpm. Propeller is a two-blade, constant speed Hartzell of 84 in. diameter. Fuel grade is 80/87 aviation. Empty weight is 1,750 lb. Useful load is 1,150 lb.

The standard model Debonair, the lowest priced of Beech's line of seven aircraft, costs \$39,995. It is similar in construction to the company's 250-hp, MT5 Bonanza except for its swept vertical tail and its simplified interior and equipment. It is lighter by 80 lb. at maximum weight, and 162 lb. at empty weight, than the \$35,169 Bonanza.

The Debonair marks the first move



NORMAL approach speed for Debonair is about 70 mph, and touchdown about 65 mph. Maximum gross takeoff speed is 140 mph.

by Beech to expand its lower-priced line and move into a new competitive area. About 180 will be produced this year. The company also plans to market two new aircraft in the \$14,000 and \$16,500 price categories and, as a related move to increase its durability, this concept may use steel tubes (AW Jan 4 p. 15). Beech, which now has about 60 dealers expects to double that number during early 1960. It does not plan to expand its 18 distributorships, American West was told.

## Performance Data

The Debonair, with a top speed specified as 195 mph at sea level, will cruise at 165 mph (true air speed) at 75% power at 7,000 ft. Still speed landing configuration, is 50 mph. Range, with two standard 34.5 gal. wing tanks, is 845 stat mi. With two optional 18 gal. auxiliary tanks, installed in wings aft and outboard of main tanks, the range increases to 1,370 stat mi.

With its winged, the Debonair is an attractive airplane. The semi-monocoque fuselage structure is of aluminum, magnesium and steel, steel covered and ribbed. Main wheels, smaller than those of the Bonanzas, are 600 x 6; the nose wheel is 500 x 5. Landing gear is equipped with Cleveland single disk hydraulic brakes. The nose wheel is steerable, through linkage, can be locked to the rubber pedals. Landing light is mounted on the nose forward gear strut.

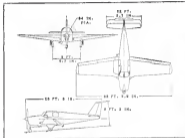
The Continental engine incorporates a continuous-flow type fuel injection system, with a special control made at the intake part of each cylinder. Fuel flow is controlled by a pressure-regulating valve linked to the air throttle in the reduction manifold. A manual mixture control arrangement overrides the throttle's control of the pressure regulator to establish a basic mixture setting. Once that setting is made by the



ENGINE INSTRUMENTS are grouped since the control control console. Flight instruments run from the left to the center of the main panel. Control handles are to the right.



BAGGAGE COMPARTMENT is aft of the cabin and is accessible through right-side door or lower main cabin. First row of seats are individually adjustable. Leg room is good.



Debonair standard model is smaller in configuration to Beech's 33B Bonanza except for its swept vertical tail and simplified interior and equipment. Base price is \$18,995.

pilot the throttle linkage via a fuel pressure to maintain the desired mixture.

Baggage compartment of the Debonair, located aft of the cabin, is accessible from inside the cabin or through a right-side 20 in. x 24 in. loading door. It is 16.5 cu. ft. in size. Cabin is entered via wing walk-up and a large right-hand door, 16 in. x 17 in. The cabin is roomy and comfortable, with adjustable adjustable front seats; leg room is no problem. Large windshield and two windows on each side afford good visibility. An optional third seat, 16 in. aft, gives an additional 20 deg forward visibility. A small hinged sun visor on pilot's side aids ground visibility.

Gauge instruments are grouped above the optional control console. Flight instruments run from the left to the center of the main panel. Stranded flight instrumentation includes an airspeed indicator, altimeter and magnetic compass. Manifold pressure and fuel pressure gauges and tachometer are located to the right. Radio equipment is mounted to the far left and includes, as the deacoustic amplifier, a Narco VTR-1A and Leon ADP-13E. Control levers are located to the far right.

Power and propeller controls, plus the master battery, battery and ground switches are located on the lower control console, within easy reach from either side of the cockpit. Three-over-type control console is adjustable for

## Beech Model 33 Debonair

### Performance

#### Maximum cruise speed:

75% power (2,400 rpm) at 7,000 ft.

85% power (2,400 rpm) at 11,000 ft.

Recommended cruise, 40% power (2,000 rpm) at 15,000 ft.

High speed, sea level (2,400 rpm, full throttle)

Never exceed speed (V<sub>NE</sub>)

Rate of climb, sea level

Service ceiling

Stall speed (standard configuration)

Stall speed (gear and flaps up)

Climbing range (45% power, 10,000 ft., 140 mph, 24.5)

Standard wing tanks (50 gal. standard)

Including auxiliary wing tanks (60 gal. standard)

Totaled run (30 day) (sea level, sea wind)

Maximum run (30 day) (sea level, sea wind)

Totaled distance in 30 ft., sea level, sea wind

Landings distance over 50 ft., sea level, sea wind

184 mph, 540

180 mph, 540

144 mph, 540

300 mph, 540

300 mph, 540

1,015 ft./min.

11,000 ft.

50 mph, 540

71 mph, 540

840 mph, 540

1,175 mph, 540

900 ft.

370 ft.

1,400 ft.

1,400 ft.

## GLOBE-ILITY



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Vought Aeronautics is meeting today's requirements with the F4U-1N Crusader. The fourth refinement of the original Crusader fighter has improved not only detecting and destroying targets at night or in bad weather. Its speed is not less than that of sound. This year the all-weather F4U-1N will join the fleet and the many other 300 Crusader fighters and photorecon aircraft in service.

#### Long range air-to-air missile

Vought Aeronautics, moreover, is looking ahead. A new concept—the long range air-to-air missile—is under development. As part of a complete missile weapons system, this missile will be a potent "next step" in upgrading our airborne defense and defense.

Patented aircraft, along with atmospheric missiles and subsonic missiles, are the products of Chance Vought's Aeronautics Division. Other major aircraft are being aggressively advanced in the company's Astronautics, Electronics, Range Systems, and Research Divisions.

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A comprehensive brochure describing SMPD engineering and production facilities is yours for the asking.



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AN OUTLET OF THE SINGER MANUFACTURING COMPANY

## Beech Model 33 Debonair

### Specifications:

Gross weight	2 500 lb.
Empty weight	1 750 lb.
Useful load	1,475 lb.
Available weight, standard:	
seats (10 gal.) full	827 lb.
Wing spars	25 ft. 30 in.
Length	33 ft. 8 in.
Height	4 ft. 3 in.
Wing area	122.6 sq. ft.
Wing loading (gross weight)	16.7 psf.
Power loading (gross weight)	15.6 lb./hp.
Cabin length	6 ft. 10 in.
Cabin width	3 ft. 4 in.
Cabin height	4 ft. 3 in.
Passenger door size	36 in. x 39 in.
Engine door size	30 in. x 24 in.
Engine compartment	34.5 cu. ft.
Engine loading (maximum)	275 lb.
Fuel capacity (standard wing tanks, installed)	40 gal.
Fuel capacity (optional aux. wing tanks, installed)	48 gal.
Oil capacity	10 qt.
Engine Continental, 100-hp model, 10-570-h	
speed at 100 hp at 2,400 rpm	
Propeller (fixed) aluminum alloy blades	
Automatically-controlled variable pitch, 64-in. diameter with fixed	
pitch hydraulic governor and	
brake system	

two wind heights. Debonair trim is controlled by a handwheel at the left of the controls. Flap extension is controlled electrically via pushover switches.

Debonair flown by AVIATION WEEK was N755AA, which weighed 1,545 lb. empty. With three at its aboard, plus 75 gal. of fuel weight approximately 2,500 lb. Field elevation at Tumbler is 7 ft. Clearance was questionable to the entire runway, up to 20 ft. Sea level pressure was 30.5. Outside air temperature was 87°.

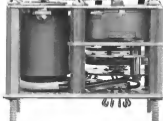
The engine fired up quickly and the Debonair maneuvered easily from the



DEBONAIR: rise of climb, gear and flaps up, gross weight 2,500 lb.

AVIATION WEEK, March 27, 1960

# FANCY STEPPER



Stepping devices from A. W. Haydon Co. can do wonderful things to adjust coil patterns... and for gears. For instance, one precision pulsed stepping switch acts as a pulse divider for a random or variable pulse source—or as a frequency divider if the pulse source is constant. Another works in conjunction with pulsed, supplying single or multiple output channels with an economy virtually equal to that of the pulse source itself. Still a third will count a predetermined number of pulses, initiate a solenoid switch, return the counter to zero and cut off the pulse source. The remote positioning device illustrated is but one of A. W. Haydon Company's fancy steppers. From a precision pulsed stepper switch has been coupled to a synchro lens former. Similarly, precise angular positioning of other components such as potentiometers, disks and indicators can be controlled. Beaded gels on the number of pulses received (not incremental changes in voltage or phase angle) it will hold a set position whether power is on or off, and will have the synchro to the zero reference on demand—ready to accept another setting. In A. W. Haydon Co. stepper motors are all electric—no solenoid linkages. Contacts at other mechanical switches are used. Torque power consumption is low, accuracy is extremely high. Send for technical brochure SPS 1 and find out more about pulse driven steppers and their applications.



**AWHAYDON COMPANY**  
212 North Elm Street, Haverbury 20, Connecticut



## Safety Valve FOR AN ASTRONAUT

If America's first man carrying rocket rats into trouble, a unique Donner device will play a vital role in bringing the astronaut safely back to earth.

Known as a "maximum altitude sensor," the all solid-state system is essentially a fixed purpose maximum analog computer housed in a magazine can only five inches long. Installed in the capsule, it goes into action if it is necessary to abort the rocket flight before the astronaut's escape tower is jettisoned.

### What It Does

The Donner device, which was developed for McDonnell Aviation with the approval of NASA, provides programmed time delay that operates escape devices at maximum altitude.

Under short condition, the maximum altitude sensor provides output information which will:

1. Energize devices for firing the escape hole, holding the escape tower into the top of the capsule. This allows the escape tower to separate.

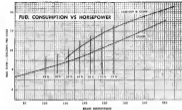
2. Energize the system which causes the escape tower section rocket to fire. With the tower separated, boosters are used to open parachute and jettison the astronaut's capsule a mile distant.

### Specified in Analog & Digital Dynamics

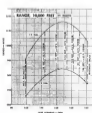
Donner's maximum altitude sensor is another product from a firm specializing in the manufacture of accurate fixed and general purpose analog and digital systems designed to analyze pressure and output signals interfacing time, acceleration, rate, velocity, and other dynamic inputs.

If you would like more information concerning the capabilities, contact your nearby Donner engineering representative or write us today.

**DONNER SCIENTIFIC COMPANY**  
CONCORD, CALIFORNIA Phone MUrray 2-8121



AT 5,000 FT., pulling 65% power, fuel pressure was 6.5 psi, less than 12 gph.



CRUISING RANGE of Debonair at 545 mi/h, 1,170 mi/mi with auxiliary tanks.

comp to the two step. Maximum nose wheel deflection, with rudder push down, is 17 deg to either side of center. With use of lock, deflection may be increased to 29 deg on either side.

Maximum thrust also incorporated a lockable decelerator for emergency use in any emergency to shunt.

Engine temperatures remained normal during taxing and rising, though there are no roof flaps. Cooling it is air which enters the openings in the case cooling flaps over the cooling fins on the cylinders and passes out through openings in the lower cooling.

### Takeoff and Climb

Normal takeoff was made with flaps up and full power applied. The airplane was airborne after a run of about 880 ft., indicating 70 mph, which quickly increased to the best climb speed of 110 kt. and a climb rate, full power, of 1,300 fpm. With gear retracted, initial power reduction to 25 in. resulted pressure and 2,400 rpm, coupled to a climb speed of 120 mph,

2,400 rpm. The fuel pressure gauge in the cockpit, in psi, initially, showing through 1,000 psi, fuel flow was 13 gph—about 11 gph. Maximum was found out at 5,000 ft.

Only light nose was necessary during ascent, and the Debonair could be used up hands off. Visibility through the large windshield window and a good view was maintained to through all phases of flight. The engine was relatively quiet and we could converse without raising our voices. The Debonair has the "kick" of a turbine aircraft, and responds smoothly to control pressures. It is not overly sensitive to abrupt or heavy-handed maneuvering.

Levelled off at 5,000 ft., with outside air temperature -42, pushing 65% power—115 in. manifold pressure and 2,300 rpm—the airplane indicated 150 mph for a true airspeed of 177 mph. Fuel pressure was 6.5 psi, less than 11 gph. At this altitude Debonair was still clear and in landing configuration—gear and full flaps extended.

### Stall Speeds

Actual stalls occurred below the maximum specified speeds. Climb the left-hand wing and warning shaker not activated at 72 mph IAS. The engine began to buffet about 65 mph and the stall occurred at 62 mph, resulting in a small loss of altitude and no wing dropping. In landing configuration the shaker warning came at 65 mph, buffet at 60 mph and a straight-away, double full-stall at 55 mph.

Descent was made to 4,000 ft. for speed checks at 65% and 75% power. Here the air pressure lock, manifold, and only a fastened seat belt prevented our head from hitting the cabin ceiling. Control surfaces and stability in the rough air was good, though there was a bit of turbulent movement. Temperature here was -42. The engine remained quite comfortable with heat (also used for windshield de-icing or recovery) supplied in a better mode in the left-center exhaust stack.

At 4,000 ft., holding 65% power—

## Debonair Range, Speed

With fuel pressure, 17 ft. height, 40 gph, usable fuel\*

Power	Range	True Airspeed	Endurance
75%	730 stat mi	160 mph	3.4 hr
65%	730 stat mi	160 mph	4.3 hr
45%	440 stat mi	160 mph	5.9 hr

With fuel pressure, no baggage, 40 gph, usable fuel\*

Power	Range	True Airspeed	Endurance
75%	740 stat mi	160 mph	4.2 hr
65%	740 stat mi	160 mph	5.4 hr
45%	440 stat mi	160 mph	7.9 hr

\*Example aircraft would have 70 lb. of equipment installed, leaving weight available for passengers, baggage, fuel & oil—not 1,000 lb.



## SAC has a Hound Dog that can slalom in the sky



Rac's CAM-11 HOUND DOG air-to-ground missile has a built-in skitter. It can hunt at pseudo-targets before turning toward its real objective. This dog-leg "slalom" approach is made possible by an inertial navigation system that is immune to enemy deceiving and jamming.

Speed and altitude variations can also be programmed into the HOUND DOG's target approach. This gives the CAM-11 even greater versatility for penetrating an enemy's defenses.

Armed with a HOUND DOG under each wing, a B-52 bomber attacks triple-threat capability. From a distance of hundreds of miles, enemy missile posts can be obliterated while the B-52 wings its internal bomb load to destination. As an alternative, the expensive HOUND DOGS can be sent right in on the main target itself.

Alternate HOUND DOGS are now being assigned to Air Force "Blue Suit Integration" crews for training use. In combination with B-52 intercontinental bombers, they materially enhance America's strategic air power.

MISSILE DIVISION  
NORTH AMERICAN AVIATION, INC.  
Downey, California



## Cessna Dealers Form Dal-Tex Aviation

Dallas, Tex.—Consolidation of two Cessna business plane dealerships in Dallas is aimed at providing a concentration of effort that is expected to provide a considerable increase in sales.

Under the consolidation, Dal-Tex Aviation, Inc., Addison Airport, Dallas, will assume all Cessna dealership and training activities formerly handled by Aircraft Sales Co., which operated from Southwest Airservice Corp., Love Field.

Former Aircraft Sales personnel have joined Dal-Tex and the area's Cessna distributors, Business Wings, Inc. James Grubbs, president of Business Wings, expects that under the consolidation Dal-Tex will sell some 75 a/c, replaces the year, compared with a total of approximately 45 last year sold in both dealers. Business Wings will expand its 1968 operations further by adding three new dealers to its organization, as it initiates a program to boost its Cessna business plane total dollar volume this year to approximately 20% its total dollar volume last year (at actual prices) to approximately \$2.5 million in new aircraft.

## PRIVATE LINES

First captain of a "wet-lease" OH-63 helicopter from Mexico to helicopter was made recently by U.S. Border Patrol on the Rio Grande during maintenance of the Bell 47G-2 by the agency. The helicopter also aided in checking automatic radio equipment atop a 7,700-ft mountain, which nearly took male horse trooper two days. The work was accomplished in a half hour.

Financial report of Southwest Airservice Corp., Dallas, for its month ended Nov. 30, 1977, shows a net income of \$11,547 after taxes on sales of \$5,225, 50% Southwest Airservice will pay a loss costs quarterly divided by April to shareholders of record Mar. 31.

French Department of Air Transportation will use a newly purchased Cessna 440 for transporting key officials and inspectors at various facilities. Sales representative for the 440 delivered in France, four additional 440s are going to French firms this spring.

Twelfth Beech service clinic, providing more than 100 major line checks, but to women who bring their airplanes to 40 designated service centers, starts in April and will run until October. Last year more than 1,500 Beech airplanes were inspected during the service clinic. More than 11,000 airplanes have been checked out since the service began in 1949.

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## GSE

New in electronic protection, Honey-Moore designed Automatic Warning Trainers will help SAC's Hound Dog equipped B-52s guard the peace of the 90s. Designed as a new modular concept, powered by Wright Air Development Center and North American Aviation, GA-M-71 ground support equipment like the HMA trainer lowers crew misjudgments in combat situations. First another milestone where Honey-Moore engineering ability and performance reputation have been called upon for advanced, reliable ground support systems for aircraft and missiles.

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**SPACE AUTOMATIC PRODUCTION** of metal shrouds with glass mat and C-D-F plastic fabric. The shroud is made by a special machine. After inspection, the shroud is ready to be used in the aircraft.



**NEW VIBRATOR (2000) OF SHROUD** is shown by the gear. The gear is 100 mm in diameter. The shroud is made by a special machine. After inspection, the shroud is ready to be used in the aircraft.



**SPACE SHROUDING AND PRODUCTION** on shroud. The shroud is made by a special machine. After inspection, the shroud is ready to be used in the aircraft.

### PROPERTIES OF SOME TYPICAL C-D-F DILECTO GLASS-BASE GRADES

Grade	Expanded Metric to all in g/m <sup>2</sup>	Thickness Metric to all in mm	Porosity Metric to all in %	Impact Metric to all in ft.-lb.	Heat Metric to all in °F	Dielectric Metric to all in 1000 Hz	Area Metric to all in sq. in.	Volume Metric to all in cu. in.
GR 100 (Glass mat)	None	14,000	0.001	45	100,000	100 +	230	
GR 120 (Glass mat)	G-2	16,000	0.002	45	100,000	100 +	230	
GR 140 (Glass mat)	G-10	18,000	0.003	45	100,000	100	150	
GR 160 (Glass mat)	G-11	20,000	0.004	45	100,000	100	150	
GR 180 (Glass mat)	G-2	22,000	0.005	45	100,000	100	150	
GR 200 (Glass mat)	G-1 and G-3	24,000	0.006	45	100,000	100	150	
GR 220 (Glass mat)	G-10	26,000	0.007	45	100,000	100	150	



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Hunt Corp., 1635 Flower St., Glendale 1, Calif.

#### Airplane Cooling System

Cooling system for engine gear, for both aerobics and general support equipment, uses fan-cooled induction fan flow, which act as diodes and heat transfer agents.

The system circulates fluid through a liquid-to-liquid exchanger case, then through the electronic gear. Circulation



rate is 52 gpm to estimate turbulent flow for maximum heat transfer effectiveness. An output pressure of 500 psi overcomes resistance to flow and holds the fluid in liquid state for maximum electric strength. Operating temperature range is from -65 to 225°F. System dry weight is 74 lb.

Vickers, Inc., Detroit 32, Mich.

#### Air Bearing Pump

An pump, incorporating a welded diaphragm bellows, is designed to supply glycerine as bearing.

The pump, 3K 1691, weighs 11 lb and is designed for integral use with a gear. The welded diaphragm bellows



allows volumetric efficiency and provides a sealed positive action to prevent air contamination. A lip-on diaphragm seal prevents glycerine from entering to lower test flow.

The pump has a 2 gpm pressure increase at a delivery rate of 2 lb/min per minute. Modules will operate on 250 V, 400 cps or on 115 V, 60 cps current.  
Barton Corp., Inc., Union, N. J.



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# Rising Costs Dictate Operations' Economy

By Paul Rabinow

Washington—Fiscal 1967 operations and maintenance funds requested by the military services represent a "low estimate" of the amount needed to meet their immediate responsibilities, military attachés told the House Defense Appropriations Subcommittee.

New obligations and requests by the Administration for Fiscal 1967 total \$18.9 billion, about \$227 million more than that made available in Fiscal 1966 and \$395 million more than in Fiscal 1965.

However, the high costs associated with the new weapon systems and growing operational strikes missions and other factors, such as wage increases, disasters and battle-die emergencies have forced the Air Force, Army and Navy to adopt extreme economy measures in order to stay within budget limitations, the committee men told.

To help offset shortages and other increased costs and still fund priority programs properly, the witnesses said, it has become necessary to reduce ships, planes, equipment, installations, flying hours and eliminate almost everything else out of an urgent nature.

Here's how witnesses viewed the

Fiscal 1967 operations and maintenance requests from the standpoint of the individual services.

• **Major Gen. R. E. Friedman**, Air Force comptroller and director of the Air Force budget—"I consider the request [54,282 billion for USAF] the lowest estimate reported in any of the last six budgets in support of the first year 1967. Air Force programs and objectives."

• **Major Gen. David W. Trosch**, Army comptroller and director of the budget—"The Army is convinced that the operations and maintenance Army appropriation request for fiscal year 1967 of \$5,112 billion is a minimum with which we can operate on a normal basis."

• **Vice Adm. R. E. Wilson**, director of naval operations for "legitimacy"—"The \$2.5 billion requested represents the minimum that must be met to meet our immediate responsibilities for providing effective naval forces now."

But even a 21.2% of Navy's total budget. It compares for funds with those accounts needed to build the future Navy. We have struck a good but fragile balance in these requests."

An Army and its \$4,292 billion request is an additional source represents an increase of \$167.1 million

over the prior year on a comparable basis.

The increases are generally attributable to the growth and expansion of air defense and warning systems including SACF, the DOW line, and BMEWS—amounting to \$54.5 million, space and missile support missions amounting to \$21.6 million and support of higher performance aircraft, such as Conquest B-58, Boeing B-52 and KC-135, Republic F-105 and Convair F-106, increases amounting to \$50.8 million. Other increases include strategic communications systems requiring an additional \$20.8 million, an additional \$8.2 million for data processing equipment and an increase of \$10.1 million for health, repair and maintenance.

These increases are partially offset by two major decreases, the Air Force told the committee—\$72.8 million derived from an overall reduction in the force structure and aircraft weapon reductions and \$36 million from a planned phase-out in the personnel program.

## Other Highlights

Other highlights of the Air Force operations and maintenance budget presentation include:

• **Reduction of fixed communications-electronics equipment**—\$68.1 million, an increase of \$74 million over Fiscal 1966. Of this, \$12.1 million is for Strategic Air Command, \$16.3 million for air defense, \$10.9 million for the DOW line, \$18.1 million for missile support, \$6.1 million for certain personnel and \$7.9 million for support personnel and air traffic control systems.

• **Turning support**—\$263.6 million, an increase of \$1.9 million over the amount estimated for Fiscal 1966. Direct support and training will decrease by \$2.9 million, primarily as the result of space vehicle support training and initiation of course preparation for the Minuteman solid-propellant ICBM. Offsetting decreases will be made in base operating costs in the Air Force program for a reduced pilot training program in Fiscal 1967. Reductions have been made in the base military and technical training loads by decreasing flying periods from 11 to 8 weeks.

• **Low-altitude program**—\$1.1 billion, a decrease of \$18.1 million from Fiscal 1966. The program provides for on-the-line maintenance of aircraft and weapons, care of aircraft, operation of control towers, maintenance of airports for troops and other day-to-day expenses

at airports, signs and maintenance required at various bases.

• **Command administration**—\$342 million, a net reduction of \$7.4 million from the current year resulting primarily from personnel cuts. The current personnel reduction amounts to 53.8 million and is partially offset by an increase of \$1.9 million for electronic data processing equipment and \$6.8 million related to civilian employees with assistance programs.

• **Aircraft fuel and oil**—\$441.5 million, a reduction of \$27 million from the current year, largely as a result of increasing fuel costs from 6.6 million to 1.1 million.

• **Depot level maintenance**—\$711.7 million, an increase of \$11.5 million from Fiscal 1966. Witnesses said these funds will be applied on a growth basis to the overall and overall support factors and provide maintenance of these weapons systems and the equipment directly related to these systems. Modification and depot level maintenance of aircraft and equipment other than those in the combat role will be provided on a non-urgent basis. Depot level repairs will be limited to work that is definitely beyond the capability of wing commands and necessary to keep aircraft airworthy. Except in those cases, no extensive or time-consuming repairs will be undertaken unless the aircraft has a special mission. In addition, there are several types of aircraft on which no depot level work is being proposed.

## Army Budget

Army's Fiscal 1967 budget requests of \$4,112 billion for operations and maintenance is \$77 million above fiscal 1966 estimate. Army stresses and the increase would slow the downward trend in operations and at the same time provide an ability to cope with increasing costs of operation.

Highlights of lower estimates include:

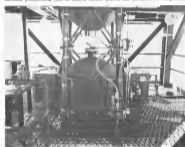
• **Tactical forces**—\$815.7 million, an increase of \$41.5 million over Fiscal 1966. One of the primary reasons for the modest increase in this program, the Army said, is that tactical units have been using supplies on hand as well as the direct obligations available to provide the resources needed to assure proper execution of high-priority missions. The command has also reached the point where further use of this resource to finance day-to-day operations is not militarily sound, Army witnesses said.

• **Training activities**—\$451.1 million, a decrease of \$7.9 million from the current year. The decrease is attributable primarily to the reduced student loads both in the regular Army and the reserve forces, because of emphasis on major overhaul and maintenance of



JPL Mounts 6,000-lb.-Thrust Test Engines

Two 6000-lb. thrust engines, together will be used by Jet Propulsion Laboratory in test advanced propulsion system, which tested system and propulsion components



Rocketdyne Displays Thrust Chamber Family

Large thrust chamber at right is the 400,000 lb. thrust F-1 main engine being developed by Rocketdyne Division of the USAF. Others are from left for Redstone (75,000 lb. thrust), Jupiter (150,000 lb. thrust), Atlas (30,000 lb. thrust) and Thor (150,000 lb. thrust).

Planes swept across the open plains as the Mongol hordes ran in terror from the "arrows of flying fire." When the smoke had cleared the Chinese had won the battle of Peking with the first rocket.

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material—\$285 million, a decrease of about \$5 million from the current year. Of the total requested, \$58 million will be used for maintenance support, \$75 million for the continued procurement of aircraft and missile parts and \$175 million for research. At the same time, the Army said it would acquire at least \$114 million more to conduct approximately \$400 million of unaccountable, expensed which is over and above the fiscal year 1960 budget of \$400 million. Due to overall capability and pressure of workload, this would require programming over time from one fiscal year.

• **Army-wide activities—\$190.7 million,** an overall decrease of \$4 million from Fiscal 1960. Program includes a cut of \$9.3 million in communications services. The \$2.5 billion requested for the Navy in operation and maintenance funds for Fiscal 1961 represents a \$55 million reduction from Fiscal 1960. To \$1 million these funds, Navy cut assets and that these have savings have been established—fleet operations, fleet maintenance and fleet logistic support in that order.

While the appropriation provides for a smaller active fleet and support, their establishment is compared with 1960, the Navy said the increased costs of expanding such programs as the Polaris fleet before missile version, fleet modernization, the modernization program and nuclear fleet will require a slightly higher level of funding to provide a balanced program.

Adm. Wilson said that 70% of the present active fleet, built during World War II, will become obsolete within the next few years, increasing the cost of maintenance problems.

Other highlights of Navy testimony:  
• **Fight operations—\$1,019.9 million,** an increase of \$4.2 million over Fiscal 1960, which reflects the introduction of new, higher performance aircraft into the fleet.

• **Weapons stock and maintenance—\$309.7 million,** an increase of \$9.4 million over Fiscal 1960. The increase provides primarily for the Navy's share of the expense health assessment, and for the check-out and maintenance costs associated with the introduction of the Polaris missile, which into operational status. Of the \$149.7 million, \$248.1 million will provide for the needs of aircraft, engines and related components.

• **Maintenance and operation of three establishments—\$54.9 million,** a decrease of \$18,000 from Fiscal 1960.

• **Service-wide communications—\$1.1 million,** an increase of \$1.1 million over the current year for operation and maintenance costs of new satellites such as limited loan for the Polaris program and transmissive cable facilities in the Pacific and Atlantic.



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## Gradual Defense Budget Increase Proposed in Rand Corp. Report

Washington—U.S. can increase its current \$40 billion-a-year level of defense spending by over \$10 billion annually "without restructuring force, our present levels of manning and logistics," according to a study made for the Joint Congressional Economic Committee by a Rand Corp. economist.

If the \$10 billion a year increase took place gradually over three to four years, the study said, "there would be scarcely any problem with inflation." If it were made abruptly, additional tax receipts would be necessary for three to four years "in order to dampen inflationary pressures, especially from anticipatory buying."

The 50-page study was made by Rand Economic Director James A. Mansueti, a Massachusetts Institute of Technology graduate in economics and electrical engineering. His conclusion that the U.S. can raise about \$10 billion a year additional in defense outlays is based upon a finding that "the U.S. will undoubtedly grow at a rate of at least 3%, close to 5% billion, per year."

It was noted that the defense budget now represents 9% of the gross national product. This compares with 10% in 1944 and 14% in 1951.

Since the Soviet Union, with approximately one-quarter the gross national product of the U.S., is currently sustaining a military effort "roughly equivalent" in dollars to that of this country, the report estimated that any substantial increase in the Soviet defense outlay in the near future would "significantly reduce consumer standards of living—because consumption is low at present and there is no slack in the Russian economy." The study also noted that "indeed, a great deal of social unrest and disorder might ensue, if the Soviet Union attempted a large expansion of its defense activities."

With the Soviet economy growing at a relatively greater rate than that of the U.S., this situation will change within a decade, according to the report. In 1970, if the Soviet Union doubles the same percentage of its gross national product to defense that it is currently devoting, it will have a defense budget of \$50 billion at U.S. prices, the report said. By 1975, it would go to \$70 billion.

The report dismissed the "budget first" approach, which maintains that the U.S. economy cannot support a higher defense level, as "irrelevant." Neglecting "possibilities" that the U.S. will increase its defense effort in a "passive" "deterring" to Communist aggression, the report commented: "If we make it

appear that our response, to aggression will not include an increase in our defense budget, this important deterrent weapon is weakened."

The "strategy first" approach also was criticized because the report said, it views a military requirement as fixed and absolute and "fails to recognize that both we and our opponents have a wide range both of objectives and of alternatives from which to choose to accomplish our objectives, that some objectives of lower strategic importance should than a pure military, both strategic and technological, advantage to military planning. It stresses that military intelligence can make precise, valid estimates of the major "best" for various future dates. The possibility that the means can make a different choice—perhaps induced by our own choices—was ignored."

The study commented that the "real ability" of the "improvements" approach is a "technical" for defending budget requests and added: "Setting a larger budget may be better than improving efficiency. Improving efficiency requires hard choices and generates conflict

within the apparatus and the commission to a higher budget is external; it is easier for the commission to make against the outside world."

The report urged both the "budget first" advocates and the "strategy first" advocates to "redefine some of their exceptions from the struggle over budget level to the problem of improving objectives." Recommendations for improving the budget structure included:

- Identify allocations by major national mission objectives. The first suggested objectives were: deterring direct attack on the U.S.; limiting damage and obtaining lost war objectives if deterrence fails; defense of major cities, and defense of other parts of the free world.
- Determining that the national objectives of freedom among nations no longer conform very closely to our objectives. The report said the present type budget "locks severely into information on how our defense effort matches our separate objectives. Most people might do not know, even approximately, what we are spending for deterring attack on the U.S. or for defending Europe or Asia. More of our defense have a contribution to make to several objectives. Nevertheless, it is instructive to select our focus in these present objectives."
- Make weapon systems to the objectives. Justification for buying ob-

## PROBLEMATICAL RECREATIONS 6



When two numbers are with play together, it is possible for the first digit of the answer to fall between the first digits of the multipliers.

—Mathematics 2-6217

Development of advanced control guidance systems has created special openings for engineers who are experienced in preliminary work through primary development of these systems for spacecraft and aircraft applications. Please write to Mr. Don Krasner in our Guidance Systems Laboratory.

ANSWER TO LAST WEEK'S PROBLEM: Taking into account the concept of a power probability and in particular the mutual environment of the faircoin tosses, the relative law of probability can be applied to the sets of matches. The application of the law results in a probability of 0.067.



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Identify specific "inputs" to support the military establishment such as personnel and maintenance. These inputs are now needed within other budget categories, such as "procurement of aircraft and missiles."

**WHO'S WHERE**

(Continued from page 27)

**In the Front Office**

Robert H. Jensen, vice president and general manager, Aero Space Division of Boeing Systems Co., Seattle, Wash.

L. Bradley Davis, a vice president of General Electric Co., is vice president of GE's Electronic Components Division, Danvers, Mass.

David S. Lewis, senior vice president operations, McDonnell Aircraft Corp., St. Louis, Mo.

W. C. Purdy Jr., vice president production, Hughes Aircraft Co., Torrance, Calif., a subsidiary of Westinghouse, Inc., Santa Monica, Calif.

Harold H. Dine, a vice president of General Motors Corp., is vice president of GM's Vehicle Division, Indianapolis.

Fred T. Miller, vice president and general manager, Bell Telephone Laboratories, Inc., is vice president of Bell's Electronic Systems Division, New York, N.Y.

Edward S. Henshaw, vice president engineering and manufacturing, Government Electronics Division of Emerson Radio & Phonograph Corp., is vice president of Emerson's Electronics Division, St. Louis, Mo.

Robert F. Knechtel, vice president operations, is vice president of the electronic research and development division of Bell Telephone Laboratories, New York, N.Y.

Dr. Samuel Silver, director of a new Space Sciences Laboratory on the Berkeley campus of the University of California.

Dr. Louis S. Gelpert, director of the newly created Electronics and Systems Analysis Office, National Aeronautics and Space Administration, Washington, D.C.

Dr. John C. McCall, member of the Undersea Warfare Division of the Development Operations Division, Naval Submarine Agency, Grotonville, Md.

**Honors and Elections**

Dr. Dallas Wright, president of Endevco Corp., has been named a director of the Top Industrial Executives, Los Angeles, Calif.

**Changes**

Benjamin H. Glaz, general manager, Avco Electronics Division of Avco, Wright Aircraft Co., Dallas, Tex.

Richard F. Hughes, manager staff in personnel relations, Chrysler Corp., Avco Aircraft Projects Organization, Detroit, Mich.

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**flight test operations****flight test  
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